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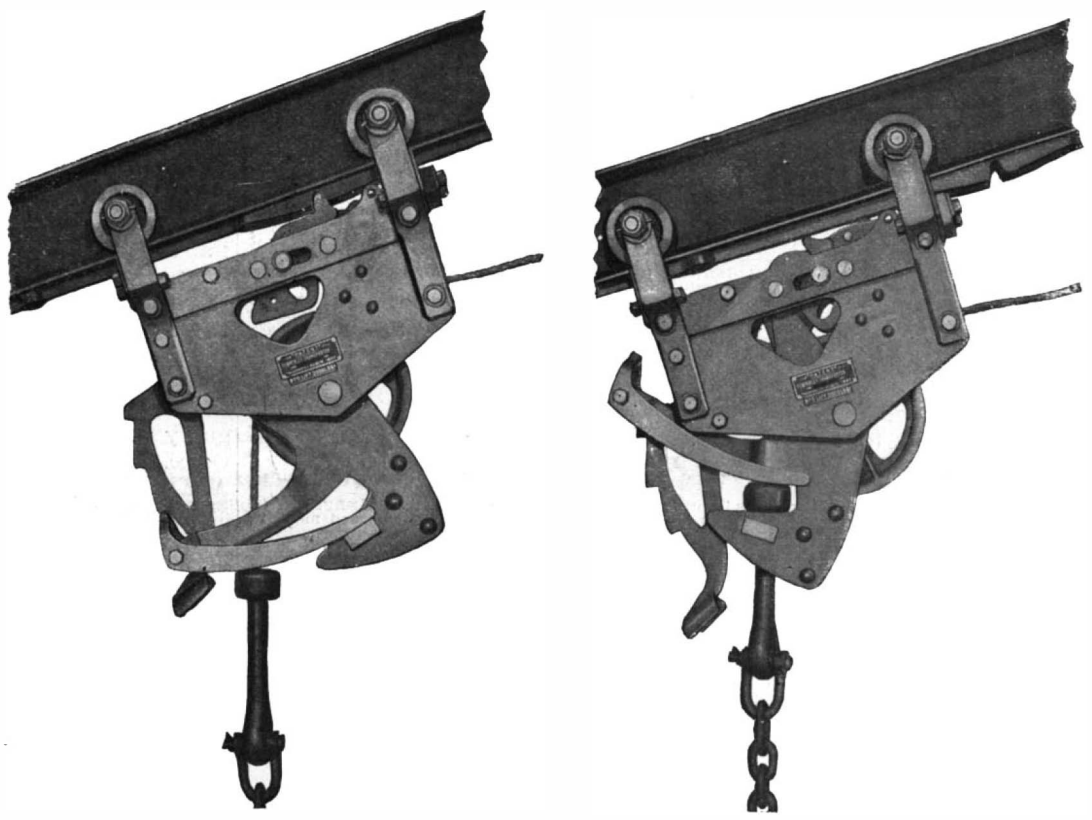
COALING WARSHIPS AT SEA.

In dwelling upon the advantages conferred upon the warship by the introduction of steam, it must not be forgotten that the new power imposed one very serious burden which is making itself increasingly felt as the speed and size of modern ships continue to increase. For whereas the masts and sails of the frigate were good for a cruise of indefinite length, the boilers and engines of the modern cruiser or battleship are available for propulsion only so long as there is coal in the bunkers. The radius of action of the steam-driven ship is determined by her capacity for carrying fuel and her distance from an available coaling station.

There are perhaps no operations of a naval war in which this limitation of the steam battleship has caused greater inconvenience than in the work of blockading an enemy's port. In the days of the sailing frigate a ship could lie for months if need be in the blockading line, and the full strength of the fleet was maintained unbroken for months at a stretch; but in a modern blockade it would only be possible to count upon a certain percentage of the ships as available, the others being absent in turn, taking on coal at the nearest station. It has been estimated that during the blockade of Charleston in the civil war fully one-quarter of the ships were absent at any given time for coaling purposes.

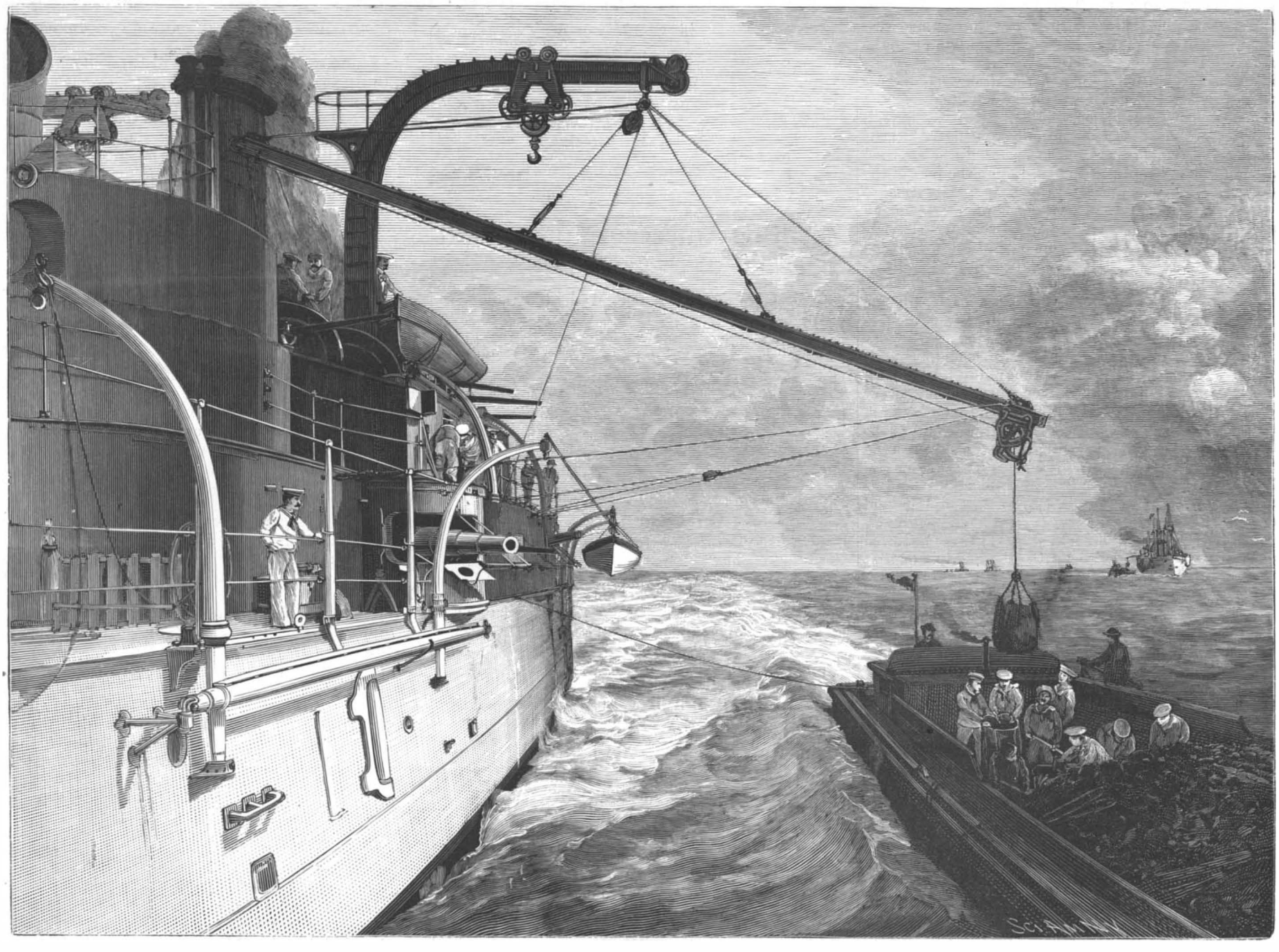
The same difficulty presented itself at the blockade of Charleston Harbor, during the recent naval maneuvers. Ships whose draught was not over 15 feet entered the harbor, where the water was quiet, and were coaled from barges lying alongside in the usual way; but had the larger vessels, such as the Indiana, Maine, New York and Columbia, drawing from 20 to 26 feet, required recoaling, they would have been obliged to steam away to Port Royal or Newport for the purpose. As it was, all of the vessels that took on coal were obliged to leave their position in the blockade, and its efficiency was impaired in proportion to the number of vessels absent at any one time.

With a view to overcoming the



Carriage locked to the beam load being raised or lowered. Load locked in carriage--carriage free to travel along the beam.

THE TEMPERLY TRANSPORTER, FOR COALING VESSELS AT SEA.



THE UNITED STATES BATTLESHIP MASSACHUSETTS COALING AT SEA FROM A BARGE WHICH SHE IS TOWING ABEAM.

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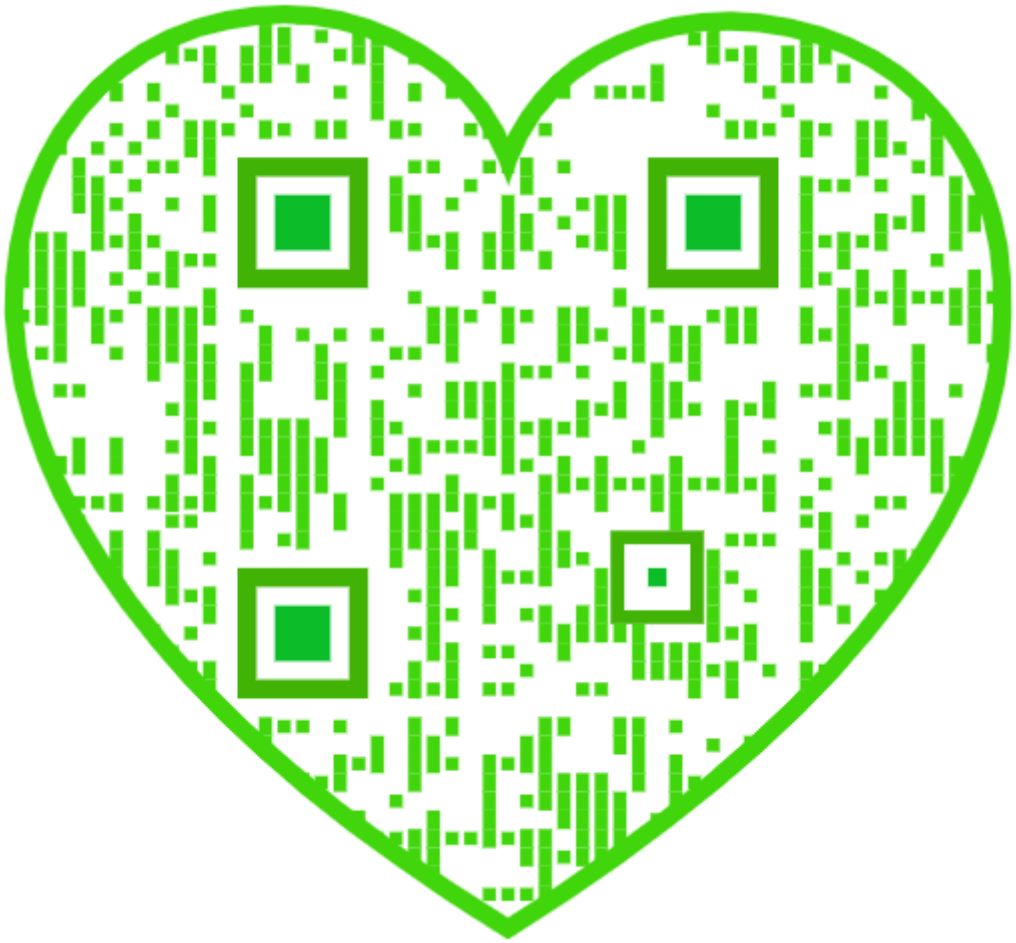

difficulty, the U. S. S. Massachusetts was recently fitted out at the New York navy yard with a coal transporter, which will enable her to take coal either when at anchorage off a blockaded port or when steaming at slow speed in moderately calm water.

The Temperly Transporter is the name by which this new form of hoisting and conveying device is known. The large engraving represents the battleship Massachusetts taking coal from a barge which she is towing abeam, at a distance of twenty or thirty feet, and at the rate of six or seven knots an hour. It will be seen that the device consists of a traveler running on a suspended beam, which reaches out over the barge and is carried from one of the boat cranes of the battleship. This beam, which is 60 feet in length, and weighs about 3,000 pounds, is suspended from a strap attached to the crane by four steel guys, and it is prevented from swinging fore and aft by means of other guys which lead inboard and are made fast to the deck of the vessel. A novel form of self-locking carriage is employed, which travels upon the lower flanges of the beam, and is capable of traversing its entire length. The beam is pitched at an angle sufficient to cause the carriage to run out by gravity, and a single hoisting rope coiled about the barrel of the steam winch serves at once to operate the carriage and hoist the load. The rope after leaving the drum is led to a sheave which is secured at the point of suspension of the beam, from thence to a pulley at the higher end of the beam inboard, and from there it passes around a sheave in the carriage and terminates in a hook to which the bags of coal are attached.

In operation we will suppose that the carriage is at the lower end of the beam over the barge, where it is locked automatically to one of the stops on the under side of the beam, the locking gear of the carriage being then in the position shown in the first figure. After the hook is secured to the coal bag, the hoisting rope is drawn in by the winch, the load rises rapidly to the carriage, where a catch on the hoisting chain, striking a lever, automatically locks the load to the carriage and releases the car from the stop above mentioned on the under side of the beam. This position is shown clearly in the second figure. The further inhauling of the hoisting rope causes the carriage to travel rapidly up the beam. The stops on the under side of the beam are spaced five feet apart, and the carriage is drawn up until it passes that one which is located over the point where it is desired that the bag shall be delivered. The winch is now stopped and reversed, and the carriage moves back until it is arrested by the engagement of the latch, which is shown at the top of the carriage with this particular stop. The dropping of the latch into the stop automatically releases the load from the carriage, and it is forthwith lowered to the deck. The bag is then unhooked, an empty bag is put on in its place, and the operation is reversed, the empty bag being run down the full length of the beam and delivered to the barge. The whole operation is performed in less than a minute, and it requires no skill upon the part of the operator. The long reach of the beam permits coal to be taken from a vessel of any description, which may stand off from the battleship a distance of from twenty to twenty-five feet, and the operation may be carried out in any sea in which it would be safe for two boats to lie at anchor at that distance apart. As the transporter is supported entirely from the battleship, no part of it can be injured by the rolling from the two vessels.

To appreciate the full advantages of such a machine we have only to suppose that the White Squadron is blockading the harbor of an enemy and that every vessel is required for the purpose. Under such conditions the coal boats could be brought directly to the scene of the blockade, and the coaling carried out upon the ground. Of course the coal barges or ships would have to be escorted by a convoy, but this ship would be necessary in any case for the transport of supplies and dispatches.

It will be evident that the coaling ship may be towed at a moderate speed parallel with the warship, and that the operation may be carried out with equal success under such conditions. The French navy, which uses this system of coaling extensively, made a successful trial of coaling the Richelieu while she was steaming under the headway of six and a half knots an hour, and they were able on this occasion to transfer one hundred tons of coal in three hours. The British Admiralty, during a series of tests, has handled forty tons an hour in bags by this same device, and it was so well satisfied with the performance that one hundred and fifty of the transporters have already been furnished to the British navy. We are informed by Mr. Spencer Miller, C.E., to whom we are indebted for the data and drawings from which our engravings and description have been prepared, that in addition to the two powerful navies above mentioned, this device has been adopted in the navies of Germany, Austria and Italy.

IT is proposed to raise 10,000,000 francs to restore the Palace of the Popes, at Avignon. It is proposed to create a museum which will illustrate the whole history of Languedoc.

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RESPONSIBILITIES OF THE NEW COMMISSIONER.

Among all the appointments which are made by an incoming President, it would be difficult to find one which calls for the exercise of more careful judgment than the appointment of the Commissioner of Patents. The responsibilities of the office are of a particularly trying character, and the relations of the commissioner to the government, the inventor, and the patent attorney invest him with a degree of discretionary judicial power which finds no parallel in the various courts of law. Inasmuch as he has the final word, so far as the Patent Office is concerned, in the settlement of all difficult cases, it is necessary that he should have, in the highest sense of the term, a judicial mind; and in addition to a general knowledge of the law he should also have a very intimate knowledge of the theory and practice of patent law. His tenure of office and its emoluments should be such as to place him entirely beyond the reach of all external influence, whether commercial, political, or otherwise, and there is no question that the permanent tenure of the position by a commissioner who has proved himself in every way acceptable would be greatly to the advantage of the Patent Office, the patent bar and the great body of inventors throughout the country.

We have spoken of the extraordinary judicial authority invested in the office. It is safe to say that there is no power possessed by the commissioner which brings with it more serious responsibility than that which enables him to disbar any patent attorney who may be guilty of unprofessional practices before the Patent Office. We say "disbar" for the want of a better term. As a matter of fact, there is unfortunately no such thing as a recognized patent bar in this country. Any attorney who conforms to the procedure of the office may file an application for a patent and argue the case before the commissioner or his representative.

It will thus be seen that the door of entrance into patent practice is about as broad as it is possible to make it. The only supervision to which the practitioner is subject is that of the commissioner, who may suspend an offender for notoriously dishonest practices. Just what degree of offense calls for disbarment seems to be left to the discretion of the commissioner. In nine cases out of ten the reason given for disbarment is embezzlement of money; that is to say, the withholding of government fees. In 1871 Commissioner Leggett issued an order that an examiner who borrowed money from an attorney would be in danger of dismissal and the attorney of disbarment. This order was approved by Commissioner Mitchell in 1889; but it does not seem that any attorney has been disbarred for this cause.

In looking over the record of disbarments for the past thirty years, it is noticed that the average number per year has remained practically stationary, in spite of the fact that practice before the Patent Office has enormously increased in the interim. The obvious inference is either that questionable practices in connection with patent soliciting are less frequent than they were thirty years ago or else that commissioners have grown lenient or have no power to act in regard to these matters. We fear that the first alternative is as unlikely as that the others are probable; and to the last, among other causes, is to be attributed the rise and growth of a certain notorious class of practitioners, whose methods are at once a snare to the inventor, a disgrace to the profession, and are liable, if not checked with a strong arm, to cast a shadow upon the Patent Office itself.

In this connection we call attention to an article in Lords' Power and Machinery Magazine which we republish on the adjoining page, in which some of the worst irregularities that have crept into the patent practice are enumerated. How far the powers of the Patent Commissioner enable him to take cognizance of these practices we do not know. If such practices do not constitute cause for disbarment, upon the presentation of charges of irregularity to the commissioner, it is difficult to find any way in which the inventor or the public can be protected.

This is the only method, so far as we can see, by which the practice of the Patent Office can be purged of this glaring and rapidly growing evil. Such a course would be more effective than any action that could be taken by the Patent Bar Association, should one ever be formed.

THE SIX MONTHS RULE IN COURT.

The United States Supreme Court has recently made a decision through Chief Justice Fuller which has the effect of sustaining the six months rule which was established and enforced in the Patent Office by the late Commissioner, Mr. Seymour. The decision was rendered in the case of Hyne against the Court of Appeals of the District of Columbia. Hyne applied for a writ of mandamus to compel the court to hear and decide an appeal taken more than forty days from the decision of the Commissioner of Patents, the forty days rule being one of the rules of the Court of Appeals. Hyne claimed that, under the patent laws, he was allowed two years in which to take this appeal as provided for in the revised statutes. He claimed the conflict between the

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court rule and the statutes and that the former was consequently invalid and asked for the writ of mandamus to set the decision of the court aside. The Supreme Court decided that the court rule was valid. This has the effect of practically establishing the Patent Office rules limiting the appeals which can be taken from one tribunal in the office to the other to six months. It should be borne in mind in this connection that on January 1, 1898, the new statutes recently enacted by Congress will be in force, and one year will be allowed under this new law in which to file amendments and take appeals. The six months rule was a Patent Office rule which was established by the ex-Commissioner of Patents, Mr. Seymour, and was in violation, apparently, of the statutes which allowed two years within which to take such action.

AMERICAN INDUSTRIAL SUPREMACY.

A recent issue of the Iron and Coal Trades Review (England) discusses editorially the relative condition of the wire industry in England and America. The facts which are given afford a striking proof of the rapidity with which a new industry is developed in the United States when once it has gained a firm footing, and they indicate also the rapid decrease in the cost of manufacture which has characterized our entrance into such industries.

According to our contemporary the English manufacturers of wire rods, wire, and wire nails are threatened with the loss of their business in consequence of the successful competition of Germany and other Continental countries and of the United States. The rivalry of Germany is of long standing and has become an accepted fact; whereas that of the United States is a more recent and has grown to be a much more formidable feature.

Thirty years ago there was no such thing as a wire industry in this country. During the progress of the Paris Exposition of 1867 Mr. Abram S. Hewitt stated, in a report on "the production of iron and steel in its economic and social relations," that the manufacture of puddled wire rods was a very extensive business in Great Britain, but that no one had succeeded in naturalizing it upon American soil. With the best grades of charcoal iron it was, indeed, possible to make good puddled wire rods in the United States, but at a cost too high to compete with the foreign article, in the production of which no charcoal was employed.

In the thirty years which have passed since Mr. Hewitt made his report, Bessemer steel has revolutionized the industry, and the United States now holds a commanding lead over all competitors. We find that a single Garrett rod mill in the United States is producing 7,808 gross tons of wire rods in a single month, which would mean an output of 100,000 tons of finished product in a single year.

The total output in Great Britain is only 200,000 tons per year, so that two such American mills would, to-day, equal the annual production of the very country upon which, thirty years ago, we were dependent for this article.

The statistics of the wire nail industry are equally striking. A single establishment, the Joliet Steel Works, produced 300,000 kegs of wire nails in 1895 and it is capable of exceeding that amount if necessary. The wages which are paid in the mills per keg of material appear to our contemporary to be "incredibly low," but it is noted very justly that the figure quoted, about 83 cents per keg, refers to a mill which is capable of producing a larger output of rods than any in England. It is the improved machinery, the careful attention to detail in the matter of saving time, and the intelligent resourcefulness of the American workman that enable our manufacturers to turn out a cheaper article, although the operatives take home a larger weekly wage than they do in England. The wonderful progress in economical production is shown by the following figures: In 1870 the average output of the mills was 14 tons of rods per double shift; in ten years this had doubled to 28 tons; during the next five years, or in 1885, as the result of the introduction of the Garrett mill, it had grown to 100 tons; and in 1895 the average output was 280 tons per double shift. Extraordinary as these figures appear to English manufacturers, our contemporary draws attention to the fact that there is no reason to doubt them, "since the prices quoted for sales speak for themselves, and it is well known that our American rivals are now offering wire rods and wire nails in most outside markets at such low prices that our home manufacturers admit their inability to understand how it is done."

That we should be able to undersell the English manufacturers in outside markets is the more remarkable when it is remembered that most of their mills are situated on or near the seaboard, whereas many of our large mills are situated inland, and a haul, sometimes of hundreds of miles, is necessary before the commodity in question can be loaded for foreign ports; moreover, when it has been carried to the seaboard, we are at a further disadvantage on account of the cheap sea freights and the vast carrying facilities of our competitor.

Our easy supremacy in the manufacture of wire is only typical of our progress in a score of other leading industries. The fact that we are able to undersell our competitors in outside markets at a time when we are producing, or are capable of producing, a large surplus above the needs of the home markets, suggests that our future commercial growth must take place chiefly in outside fields. There is no reason to doubt that our foreign trade could be greatly and rapidly extended if a systematic, thoroughly well organized effort were made to open up new markets and enlarge those that exist. If our consular service were strengthened, and if its efforts were supplemented by the establishment of local bureaus for the display of our products and for gathering and disseminating information likely to foster our trade with foreign countries, it is likely that we could soon open a market for our surplus product and bring back something of the industrial activity of the early years of the present decade.

A CIRCULATING PICTURE GALLERY.

It is strange that the thought of an enterprise should have slept through all the ages to become a reality in these last days of our century. To whom the conception is due we know not, but its materialization we owe to the Hull House settlement, Chicago, says the Critic. The gallery at Hull House consists of about fifty framed reproductions. Some of them are the publications of the Arundel Society, but in addition to these there are colored prints of Fra Angelico's angels, and many photographs of paintings by the old masters Modern art is not entirely neglected either, Millet, Bastien Lepage, and Abbott Thayer being the most important of the latter painters represented.

A few water colors are also included, though the gallery is mainly photographic. Each of these pictures may be taken out for two weeks at a time, a privilege which may be once renewed; but this limitation is not too rigidly adhered to. No charge is made, and no security required, except a certain knowledge of the subscriber and his address. Men and women of the working classes take a lively interest in the gallery, but its most enthusiastic patrons are children.

The pictures are all framed, and they are well cared for by the temporary owners. The most popular of them are Fra Angelico's Paradise, the Sistine Madonna, and several other Raphaels, the Presentation in the Temple of Carpaccio, and, curiously enough, Bastien Lepage's Jeanne d'Arc. Imagine that beautiful, serene, exalted face in a bare, ugly room on West Halstead Street. It could not remain there two weeks without having some subtile, uplifting influence. And for this reason the new enterprise seems one of the most beneficent that Hull House has undertaken, outranking even the library, for the reason that everything the gallery contains is of fine quality, is true art.

That is what we need—to have art brought close to the people, to make them see it and feel it and live with it. It should be a part of themselves, as necessary and inevitable as food and shelter. To rich and poor alike in this country it is still alien, still a thing apart, too much of a luxury to be taken into our daily lives, too exalted to become a part of our daily thoughts. We talk about it, we criticise and patronize it; we even, when much aroused, admire it; but we do not love it. It is like a foreign language to us, and we have yet to learn to think in it.

DANUBE-MOLDAU-ELBE CANAL.

The agitation in favor of a canal which, starting from Vienna and proceeding in a northwesterly direction to Budweis, on the Upper Moldau, then utilizing the Moldau and the Elbe, would connect the Black Sea with the North Sea, now finds support in the Monatschrift für den Offentlichen Baudienst, the official organ of the Austrian ministry of the interior. The idea, of course, goes back to remote times. Charles IV, the stepfather of the German empire and father of his own country, Bohemia, made a cutting through the Rosenberge as a starting point for the canal in 1366. Two hundred years later a full project providing locks was drawn up. The Austrian government has as yet dreaded the expense, and not taken any steps. But a committee has long been appointed, and of three projects submitted, that of Lanna-Vering has been approved of. The survey and the preliminary work have been done. It is now a question of funds. It is estimated that 2·1 meters of water (nearly 7 feet) could be secured all the way from Vienna to Ausrig on the Elbe (near the frontier of Saxony), with the expenditure of 100 million florins (about $50,000,000); and it is pointed out that Germany might help, since the distance Hamburg-Sulina would be diminished by 55 per cent and Hamburg-Constantinople by 41 per cent. That may not be a strong argument, but Germany contributed nearly $5,000,000 to the St. Gothard railway funds—a somewhat similar case of indirect interests.

THE electrical works and laboratory of Mr. Harry Barringer Cox, at St. Albans, Eng., which were totally destroyed by fire on Feb. 22, contained a valuable collection of electrical and other instruments, with the records of Mr. Cox's ten years' research into the problem of the cheap direct conversion of heat into electricity. Every one of his experiments had been photographed, and all these photographs were lost. We understand that Mr. Cox has been attempting to make a thermopile which would be commercially practicable as a generator of electric current.

A WARNING TO INVENTORS.

In this nineteenth century the profession of patent solicitors is degenerating from the professional to the commercial. Inventors and patentees have their attention arrested by flaming announcements, with the object of catching unwary inventors and patentees. One class of these agents offers medals as certificates of value of inventions, and large lottery prizes, amounting to thousands of dollars, to inventors who place their applications for patents in their hands. However, before a medal or prize is awarded these inventors, in order to become acceptable competitors, they are compelled to pay into the hands of these agents certain fees.

These competing inventors are induced to believe that a scientific and mechanical corps of experts in the employ of these agents makes crucial examinations of their inventions, in the light of the prior state of the art, and the inventions of all others who are competing for a medal or the prizes, and in due time they respectively receive a communication from their agents, accompanied by a medal, certifying that they have been awarded the medal by a corps of experts, on the ground that the invention is determined to be the best of all others presented to them for patents. At some subsequent period it is announced that the money prize has been awarded to A, B or C.

It would seem that intelligent men would not fall into such traps in this enlightened age; but alas! they, like innocent lambs, are led to enter and made to suffer, or are dealt with in the same manner as are unsophisticated rural citizens who fall into the hands of "green goods" merchants.

For many years the story of the gold [gilded] medal awarded by a French scientific society to United States patentees has been well known, and yet victims are constantly being made. When the announcement is received from Paris that the gold [gilded] medal has been awarded to a United States patentee for his invention, after an examination by its savants, and that it has been found to be the best of the kind patented, there is a demand for a considerable sum of money to pay the expenses of the transmission of the medal to this country.

The expectation of receiving this sum of money is the secret of all the interest that this French association manifests in regard to United States patentees. A bald attempt to get money for a gilded medal, issued by a set of questionable persons, ought to be understood by intelligent patentees when they read the word "gilded" in small letters, inclosed in brackets, following the word gold. Such medals, whether American or foreign issues, should not be accepted by inventors, or investors in inventions of others, as proof of merit. They are nothing more than sawdust sold by "green goods" men.

Recently an inventor applied to one of the United States medal awarding patent agents and received a medal, but no patent; and after he had expended about $175 as fees to this agent and to the Patent Office, he made a visit to Washington, D. C., and called on the chief of police in respect to his patent business, and finding that his money was wasted and beyond recovery, requested him to refer him to an honest, reliable and capable patent counselor and solicitor, and being given the name of a respectable house in Washington, he visited the same, and on entering the door he said: "I am referred by the chief of police to you, as the kind of patent solicitor I am seeking. I do not want a medal awarded me, for my medal has cost me $175, and no patent has been granted me. I want such an honest, reliable attorney, that, when he takes my case, and I pay him my money, I can go home and feel satisfied that all will be done squarely, and I shall get a patent for my invention from the United States Patent Office, instead of a mere medal from my agent." The experience of this inventor ought to be a warning to others, and the course that he pursued should be followed by them.

Another trap set for patentees is the one that the Inventive Age, of Washington, D. C., has for many months been warning patentees against. This trap is set by the patent right selling agent, who sends to every patentee a letter, which letter says: "Your patent has been examined by our scientific board or corps of mechanical experts, and it has been pronounced to be worth $25,000, or $50,000, or $100,000, and we would like to have the agency for selling your patent." Furthermore, offers are made to take out foreign patents on already issued United States patents for one-half the usual fees, etc. It is only necessary to say that patents in many foreign countries for United States patented inventions, which have been published in the United States Patent Office Gazette fully enough to be understood by practical mechanics, are invalid, even if granted by such foreign government.—Lords' Power and Machinery Magazine.

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THE MOST POWERFUL LOCOMOTIVES IN THE WORLD.

The accompanying illustrations give a correct impression of the great size of a set of mountain locomotives which have recently been built for the Northern Pacific Railroad by the well-known Schenectady Locomotive Works. In respect of boiler and cylinder power they are undoubtedly the most powerful locomotives ever constructed in this or any other country. It is true there is a freight engine on the New York, Lake Erie and Western Railroad which weighs 192,000 pounds and has 170,000 pounds on the drivers, but it has only 2,443 square feet of heating surface, against nearly 3,000 square feet in the Northern Pacific compounds.

Four engines of this type are already at work and twelve have been ordered. They are to be used as "helpers" in hauling trains across the summit of the Rocky Mountains between Helena and Missoula, Montana. The grade is excessive, 116 feet to the mile, and 17 miles in length, and, as the overland freight and passenger trains on the Northern Pacific road are very heavy, there is every economy to be realized in the use of extremely powerful engines.

As we look at this giant end on, it really appears as though the limit of possible dimensions had been reached—at least with the present gage of track. The boiler is 72 inches in diameter and the low-pressure cylinder is 34 inches in diameter, the latter dimension being not far short of the boiler diameter of some locomotives of forty years ago. The compounding is carried out on the Schenectady two-cylinder system, and it is arranged with the intercepting valve which is in common use on all the later compounds turned out from this works.

The boiler is of the extended wagon top type. There are 332 tubes, 2¼ inches in diameter and 14 feet long, their total heating surface being 2,721 square feet. The firebox is 10 feet long, 42 inches wide and 77 inches deep at the front and 73½ inches at the back. It is built of carbon steel, with ½ inch tube sheet, ⅜ inch crown and $\frac{5}{16}$ inch back and sides. The plate for the first ring of the boiler is $\frac{11}{16}$ inch thick and measures 71¼ inches by 224 inches. The heating surface in the firebox is 206·5 square feet, and the grate surface is 35 square feet, the rocking grate being used.

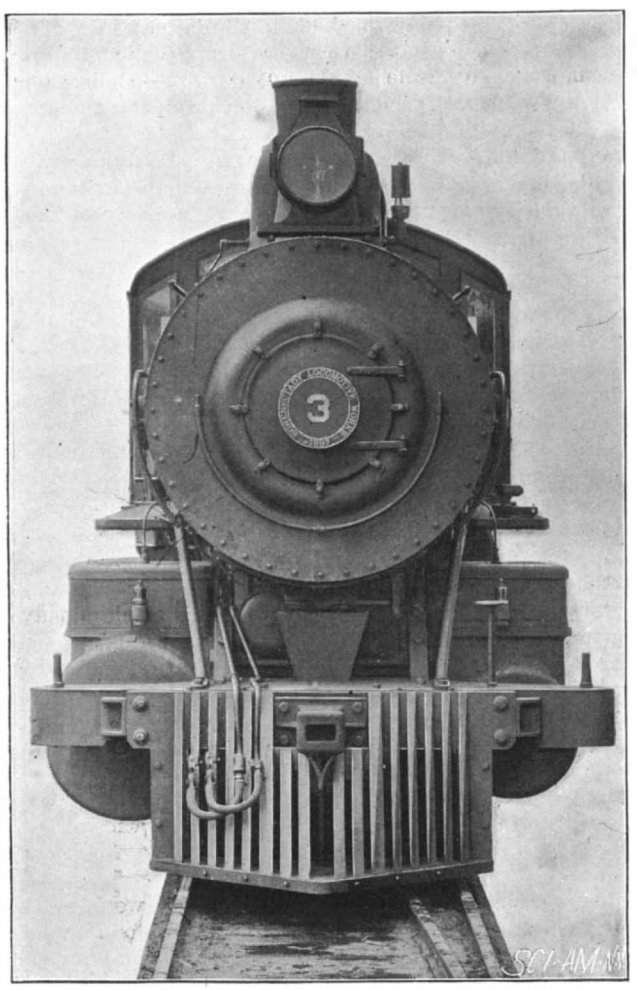
The high-pressure cylinder is 23 inches in diameter and the low-pressure, as stated, 34 inches, the latter being by far the largest cylinder ever used on a locomotive. The stroke is thirty inches. The high-pressure cylinder is bushed to 22 inches, so that it may be possible to investigate the question of the best relative proportions for high and low pressure pistons. Both pistons have their rods carried through the cylinder heads. The steam ports of the high-pressure cylinder measure 20 × 2⅛ inches, and of the low-pressure cylinder, 23 × 2⅛ inches. The exhaust ports are respectively 20 × 3 inches and 23 × 3 inches. Allen-Richardson slide valves are used; the greatest travel is 6½ inches, and the outside lap 1⅛ inches. The boiler pressure is 200 pounds to the square inch.

There are eight coupled driving wheels, 55 inches diameter, and the main driving wheel journals are 9 by 10 inches, and the intermediate front and back driving journals are 8½ by 10 inches. The main crank pin journals for side rod are 7 inches diameter by 5¼ inches long, and for main rod 6½ inches diameter by 6 inches long.

The total weight of the engine in working order is 186,000 pounds, and the weight on the drivers 150,000 pounds. The fuel used is bituminous coal. The tender weighs 36,300 pounds, empty. It has a capacity of 4,000 gallons of water and 7½ tons of coal. The total length of the engine and tender over all is 62 feet.

It can readily be believed that these giant machines have enormous hauling power. They are credited with a drawbar pull of from 35,000 to 40,000 pounds. We are informed that a builders' trial of their hauling power was made on the New York Central and Hudson River Railroad, at Schenectady, where one of these engines hauled 58 loaded cars up a grade of 60 feet to the mile for a distance of three miles. The united efforts of a switch engine and a mogul freight engine had previously failed to pull the same load.

Our thanks are due to Mr. A. J. Pitkin, superintendent of the Schenectady Works, for the photographs and particulars of these remarkable engines.



TWELVE-WHEELED COMPOUND LOCOMOTIVE, NORTHERN PACIFIC RAILROAD.

Front view showing great size of boiler and cylinders.

The World's Costliest Book.

The most expensive book ever published in the world is the official history of the war of the rebellion, which is now being issued by the government of the United States at a cost up to date of $2,334,328, says the Chicago Record. Of this amount $1,184,291 has been paid for printing and binding. The remainder was expended for salaries, rent, stationery and other contingent and miscellaneous expenses, and for the purchase of records from private individuals. It will require at least three years longer and an appropriation of perhaps $600,000 to complete the work, so that the total cost will undoubtedly reach nearly $3,000,000. It will consist of 112 volumes, including an index, and an atlas which contains 178 plates and maps illustrating the important battles of the war, campaigns, routes of march, plans of forts and photographs of interesting scenes, places and persons. Most of these pictures are taken from photographs made by the late M. B. Brady, of Washington. Several years ago the government purchased his stock of negatives for a large sum of money. Each volume will, therefore, cost an average of about $26,785, which probably exceeds that of any book that was ever issued. Copies are sent free to public libraries, and 1,347,999 have been so distributed. The atlas costs $22 and the remainder of the edition is sold at prices ranging from 50 cents to 90 cents a volume.

There does not seem to be a large popular demand, for only 51,194 copies have been sold for a total of $30,154. Thus it will be seen that the entire proceeds received from sales thus far but slightly exceed the average cost of each of the 112 volumes. The books can be obtained by addressing the Secretary of War.

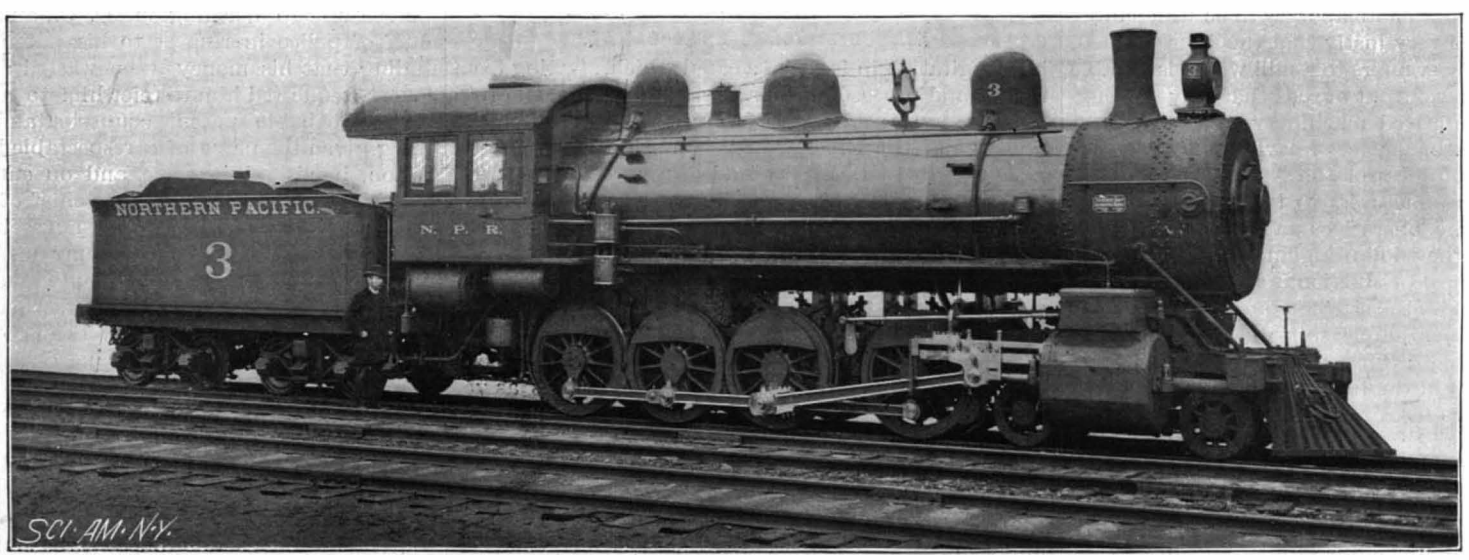
The material used in the preparation of these histories is taken from both the Federal and Confederate archives, and is purely official. The reports of commanders of armies, corps, brigades, regiments, etc., are carefully edited and arranged so as to give a consecutive account of all engagements, with as little duplication and unnecessary material as possible, and as the writers represent both sides of the struggle, it may be regarded as impartial.

Disturbing Nature's Balance.

The great and growing cost of the attempts in Massachusetts to exterminate the gypsy moth shows how serious may be the consequences to "the balance of nature" by the introduction of foreign insects or animals. A few of these moths were imported some years ago by an entomologist residing near Boston, says the New York Times. Several of the captives escaped from custody, and the State has spent $450,000 in the last four years in a vain attempt to exterminate their descendants. It is now estimated that at least $1,575,000 will be required, and that the appropriation for five years to come should be $200,000 per annum. On the other hand, a perpetual appropriation of $100,000 per annum would serve to confine the moths to the district in which they are now found.

The problem resembles that which has taxed the resources of the Australian colonies since the progeny of half a dozen rabbits, imported from England, became so numerous that the maintenance of agricultural industries was menaced by their depredations. Australia has expended millions in rabbitproof fences and in devices for killing off the rabbits. But, although bacteriologists have endeavored to remove them by disseminating the germs of fatal disease, the colonists have thus far been able to do no more than hold the animals in check.

In Florida several rivers have recently become choked by the rapid growth of a kind of hyacinth imported a few years ago, and considerable expenditures will be required to keep the streams open for navigation. An imported insect called the black scale menaced the fruit industry in California until the State procured from Australia and introduced in the orchards a little beetle which ate the obnoxious insects and thus brought relief. These and other instances which might be cited show that the utmost caution should be observed with respect to the introduction into any country of insects or plants for which nature has made no preparation there, and the growth of which may not be restrained by natural enemies and checks with which they must contend in the countries from which they are brought.



TWELVE-WHEELED COMPOUND LOCOMOTIVE, NORTHERN PACIFIC RAILROAD.

Weight of engine alone, 186,000 pounds; 23 inches and 34 inches diameter by 30 inches stroke; heating surface, 2,943 square feet; steam pressure, 200 pounds.

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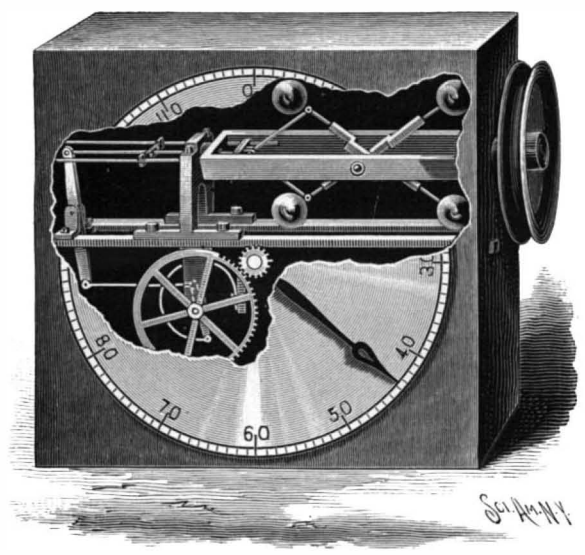
AN IMPROVED SPEED INDICATOR.

The illustration represents a speed indicator especially adapted to show the speed in miles of a railway train, or the speed by number of revolutions or feet for any piece of machinery. The invention has been patented by Henry Herden, chief engineer of the Buffalo and Susquehanna Railroad, Wellsboro, Tioga County, Pa., and is for an improvement on a formerly patented invention of the same inventor, designed to improve the construction and render the indicator more accurate. Upon a skeleton horizontal partition within a suitable casing are bearings supporting a shaft having a central rectangular opening in which two levers are pivoted at



HERDEN'S SPEED INDICATOR.

their centers. The levers are perfectly balanced upon the pivot pin, each arm carrying a weight at its outer end, and the inner ends of the levers are pivotally connected by links with a sliding crossbar, from which a rod extends centrally through the shaft and bearing to a swivel connection with a crosshead, which may be shaped to form an oil receptacle. The crosshead slides on horizontal guide bars and is pivotally connected by a link with a balance lever from whose lower end a connecting rod extends to an upper arm upon a spindle carrying a segmental gear, an opposite arm upon the spindle being attached to one end of a spring whose opposite end is secured to a hanger, the spring being designed to equalize the centrifugal force of the levers. A wheel having only a portion of its periphery toothed is employed instead of a segment, as affording a more perfect balance, and the gear is in mesh with a pinion whose spindle carries a pointer moving on a dial on the outer side of the case. To limit the movement of the levers when the index hand is at zero on the dial, a set screw is placed on the moving shaft in position to engage the outermost weight of one of the levers, the shaft being connected by belt and pulley with the machinery whose speed is to be indicated. This indicator is designed to be placed at any angle to the level plane, and not be at all affected by the jolting of a moving train or other forces, the indicator hand moving or remaining stationary as the speed of the machinery changes or remains even.

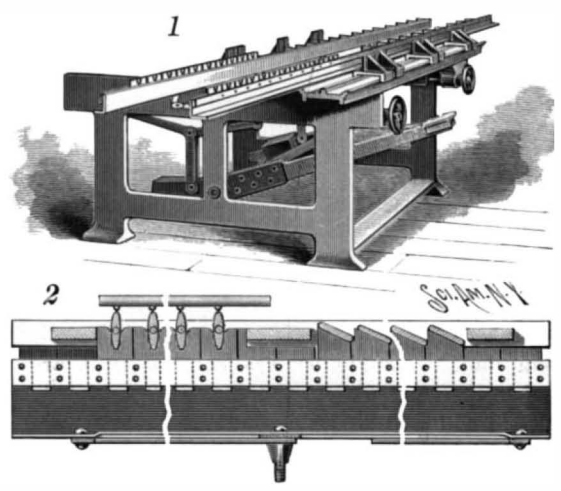
A NEW BLIND SLATTING MACHINE.

A thoroughly tested machine, in which it is stated one man has slatted, clamped and doweled from two and a half to three and a half as many blinds in a day as would be done by hand according to the present system, is shown in the accompanying illustration. The tests were made by men unused to working the machine, and it is claimed that two men, after becoming proficient in its use, will be able to clamp, slat, and dowel not less than six hundred blinds per day, ready for the rabbeting machine. The new machine has been patented by George I. Parks and William D. Nelson, of No. 427 Walker Street, Augusta, Ga., Fig. 1 showing the machine in perspective and Fig. 2 being an enlarged sectional view. Arranged at each side of the frame of the machine are frame-clamping dogs mounted on bars which may be moved toward and from each other by operating a foot lever, and between the dogs are two slat-supporting plates pivotally connected by links and a central bar, the plates being adjustable toward and from each other according to the length of the slats to be connected with the blind frame. Detachably connected to the upper portion of each slat-supporting plate are slat-holding teeth, those at one end supporting rolling slats and those at the other end stationary slats, as shown in our view, although the machine may be arranged to slat all rolling slats or all stationary slats. In operation the side rails of a blind are placed in the blind clamp and the dogs and clamp closed to bring the rails toward the slat-supporting plates, as many slats as desired being placed in the holding teeth. The side rails being blocked up so that the holes will come opposite the tenons of the blind slats, the frame-clamping dogs are moved toward each other, when the side rails engage with the slats, after which the entire blind may be wedged and doweled, or pinned at once. The machine is designed to do the work with greater accuracy, as well as with much greater rapidity, than it can be done by hand, and is adjustable to any size of blinds.

TEST OF A THREE HUNDRED HORSE POWER STEAM TURBINE.

In the common form of steam engine there is a serious loss arising from the fact that the cylinder is connected alternately with the steam supply and with the exhaust. The lowering of the temperature of the cylinder during the latter condition causes the condensation of a certain amount of the next supply of steam that is taken in, and this represents an actual loss of energy. The amount of loss will vary according to the range of temperature to which the cylinder is subjected. This difficulty is inseparable from all engines which utilize the expansive power of the steam in a closed cylinder. In the endeavor to reduce the variations of temperature, the steam has been expanded in two or more cylinders, and the quadruple expansion engine of to-day is giving economical results which fully justify the multiplication of parts and increased first cost of its construction.

The closed cylinder engine is finding a formidable rival in these later days in the steam turbine, or rotary impact engine. In these machines the energy of the steam is utilized by discharging it at an enormous velocity against the buckets of a wheel. The steam acts merely by its velocity and not, as in the expansion engine, by pressure. In order to secure the greatest possible velocity, the steam is expanded during the last few inches of its travel through the nozzle, the expansion being secured by making this part of the nozzle divergent. The theoretical speed of the steam as it finally strikes the buckets is enormous, and in the case of a jet with an initial pressure of 75 pounds, discharging into a condenser in which the pressure is 1½



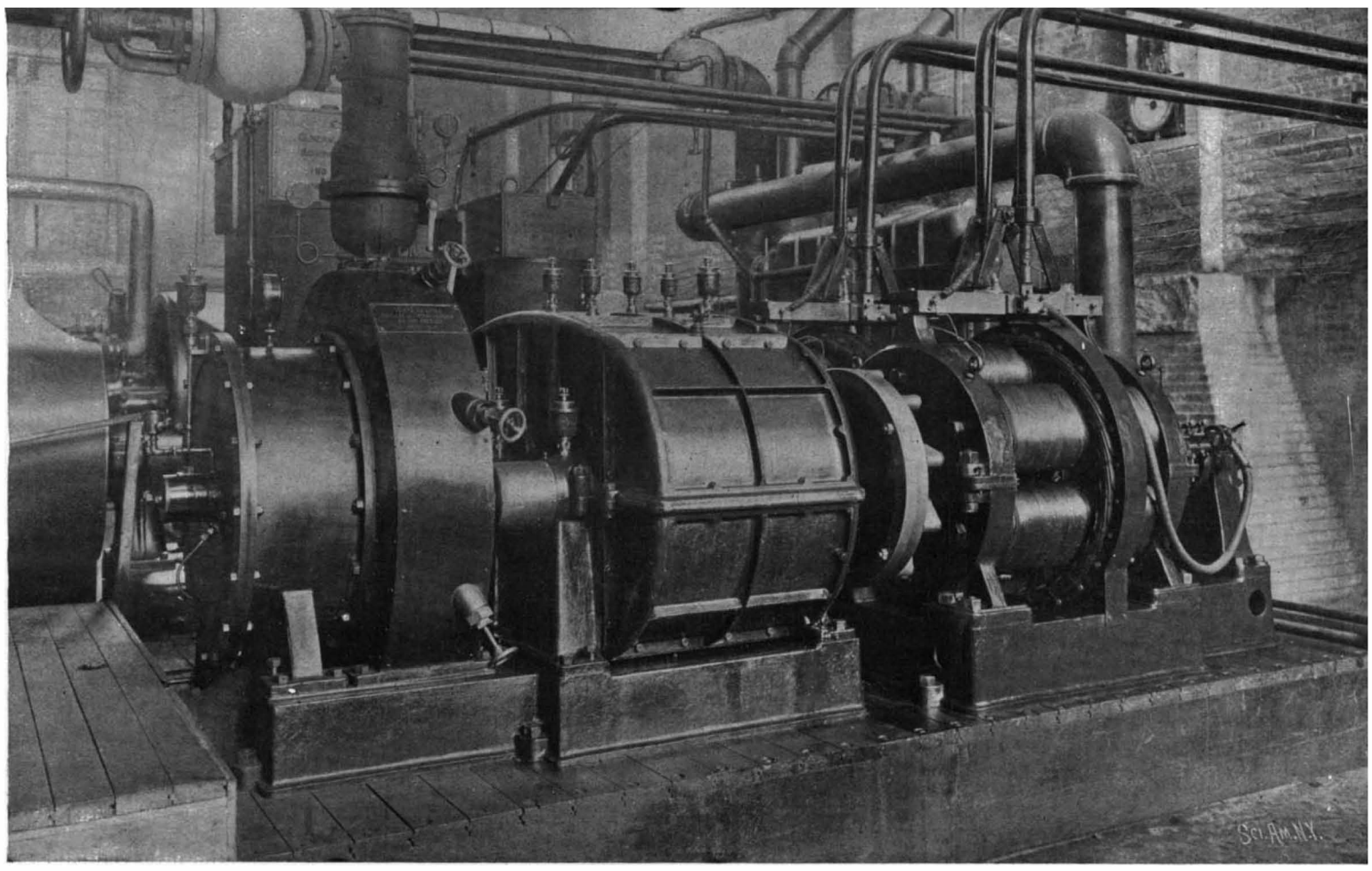
PARKS AND NELSON'S BLIND SLATTING MACHINE.

pounds, the speed would reach the theoretical speed of 4,600 feet per second.

There were great possibilities in store if engineers could only construct a rotary engine which would stand the enormous speed of rotation that was necessary in a steam turbine.

De Laval, in France, and Parsons, in England, each working on his own lines, have produced turbines which have shown their ability in actual test to give an electrical horse power on less than 20 pounds of steam per hour. De Laval did not hesitate to develop the total energy of the steam at a given pressure upon a single wheel, and he has built turbines that ran at the rate of 30,000 revolutions per minute. Parsons made use of several wheels and reduced the pressure of the steam in several stages. The steam was led through one set of turbines into a receiver. From this receiver it passed through a second set into another receiver, and so on until the steam finally reached the condenser.

The accompanying illustration shows a three hundred horse power De Laval steam turbine which is running very successfully at the Twelfth Street station of the Edison Electric Illuminating Company, New York City. The steam is led into a circular steam tight casing in which is located the turbine wheel. This wheel has a diameter of 29½ inches, and runs at 9,000 revolutions



LAVAL THREE HUNDRED HORSE POWER STEAM TURBINE.

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per minute, the speed of the buckets being 1,160 feet per second. The blades are arranged around the periphery and are milled out of the solid steel spokes with which the wheel is built up. They are made very thin at the edges and are of a curved cross section. A steel band is left on around the periphery, in order to prevent the steam from passing out over the ends of the blades; and it also serves to oppose the tendency of the turbine to act as a fan. The steam enters the turbine chamber at a pressure of about 147 pounds, and it is directed upon the wheel by means of eight nozzles of the kind which we have already described. These nozzles are inclined to the sides of the wheel at an acute angle, and the face of the nozzle which lies opposite the line of the buckets is beveled to match the angle so formed. The wheel runs, as we have said, at the enormous speed of 9,000 revolutions per minute. This, of course, is not so high as that of some other turbines of this type, which have been run at the speed of thirty thousand revolutions per minute; but in the latter case the wheels have been very much smaller. De Laval found it a very difficult matter to perfectly balance a wheel at this high speed. The center of gravity of the wheel and the axis of the shaft upon which it turns are never exactly the same. To overcome the difficulty the wheel is mounted upon a long flexible shaft, so that when the turbine is running at high speed the wheel revolves on its true center of gravity, the axis of the shaft springing sufficiently to allow this adjustment to take place. The turbine shaft extends into a cast iron gearing box, where it carries a pinion whose teeth are helicoidal and are inclined at an angle of 45° in opposite directions. This pinion operates two toothed wheels, whose gearing is also helicoidal, which are placed symmetrically on each side of the pinion. The shafts of these two gears extend through the gearing box and operate two Desrozier 100 kw. dynamos which are connected on the three-wire system. The proportion of the gearing is such that the speed of the dynamo is reduced to 750 revolutions per minute.

The regulation of the turbine is effected by means of a centrifugal governor which is driven from the shaft of the larger gear wheel. The segment weights or wings of the governor are movable on knife edges with very little friction. When the governor revolves the weights diverge, their inner ends push a pin forward, this pin in turn causing the cut-off of the steam through the movement of the balanced valve in the steam supply pipe at the top of the turbine. A spiral spring inclosed in the governor keeps the weight in a state of equilibrium at a speed of 750 revolutions. After the steam leaves the bucket it passes into an exhaust chamber which will be noticed on the left end of the machine. This connects by the large pipe with a Wheeler surface condenser conveniently placed in any part of the station.

It will be noticed that in consequence of the great velocity of the steam turbine as here described the system as a whole presents proportions the reverse of those to which we are generally accustomed. Unlike the pressure engine, here it is the prime mover which has by far the smallest dimensions; then come the gearings with their inclosing jacket or case, and finally the relatively reduced speed but heavier parts of the dynamo. The advantages of this form of motor are its great simplicity, its compactness, the absence of heavy foundations, the great regularity and evenness of the running, the great ease with which a condenser may be adapted, and lastly, and for certain classes of work most important of all, its efficiency.

In the following table is given a series of one hour tests of the Twelfth Street station turbine when it was running respectively with 2, 4, 6 and 7 jets in use, from which it will be seen that, with 7 jets in use, it gave an electrical horse power on 19·95 pounds of steam:

TEST OF STEAM TURBINE, WHEN OPERATED WITH 2, 4, 6, 7 JETS.
(One hour duration each test.)

No. of jets used.	Average load.		Average watts.		Per cent of full load.	Vacuum.	Lb. of steam per E. H. P.
	+ Amps.	— Amps.	+	—			
2	153·78	147·15	18 707	18·283	18·50	27·00	27·35
4	433·60	455 80	54·156	57·886	56·02	26·43	20·22
6	700 85	718·65	87·746	91·268	89 51	26·07	19·75
7	771·94	787·33	97·418	100·856	99·14	25·79	19·95

A six-hour test gave the following results: The dynamo outputs showed on the + dynamo 127·25 volts, 692·48 amps.; and on the — dynamo 128·26 volts, 709·18 amps. The average amount of water consumed per electrical horse power hour was 19·275 pounds. The temperature readings, after the six-hour run, were as follows:

	+ Dynamo.		— Dynamo.
Armature	120° F.	—	129° F.
Average of fields	98°	—	107°
Commutator	144°	—	132°
Temperature of room	—	82°	—
Temperature above room:			
Armature	38°	—	47°
Field	16°	—	25°

In this connection it is interesting to note the tests of a Parsons compound steam turbine, which were recently carried out by the Newcastle (England) and District Electric Lighting Company. The turbine made 9,400 revolutions per minute, the speed of the alternator and exciter being 4,700 revolutions per minute. The steam pressure was 70 pounds. The total water used per electrical horse power per hour was 17·28, 20 and 22·01 pounds respectively.

We are indebted to Mr. J. W. Lieb, Jr., general manager, and Mr. J. Van Vleck, constructing engineer of the Edison Electric Illuminating Company, for courtesies extended.

Archæological News.

The Palais de Justice, at Brussels, one of the noblest of the modern buildings, has now a pair of bronze doors. About fifteen tons of bronze were used, and in size and weight the doors stand second to the Pantheon alone. In spite of this great weight the doors are easily moved, for steel ball bearings are provided to avoid friction.

The library of the late Prof. Curtius, who was one of the most distinguished among the German classical scholars of the last fifty years, has been recently purchased by Yale University. The library was purchased intact. It was one of the finest libraries of the country on works on Greek art and archæology. It contains about 3,500 bound volumes and as many pamphlets.

M. Dalou's group, the "Triumph of the Republic," which was commissioned several years ago for the Place de la Nation, Paris, is not yet entirely completed. A little of the work was set up in 1889 to celebrate the centenary of the fall of the Bastille. The models were allowed to remain in position for several weeks and became much deteriorated, and M. Dalou was compelled to remodel the whole group. The founding is still to be undertaken; so it is possible this magnificent group will not be erected until 1900.

Professor W. Weiler thinks the ancient Etruscans were acquainted with the lightning rod. The poet Lucan has the following reference to Aruns, an Etruscan of considerable learning. "Aruns, dispersos fulminis ignes colliget, et terra maesto cum murmure condit." "Aruns collects the scattered fires of lightning, and with sad rumble hides them in the earth." (Lucan, Pharsalia, I, 606.) This quotation seems to indicate a knowledge of some way of conducting lightning harmless to the earth.—Elektrotechnische Rundschau.

A society was formed at the Congress of Art Critics, at Nuremberg, 1893. Its object was to give good photographic reproductions of masterpieces which are little known, being preserved in galleries which are seldom visited. In the private and often in the public galleries of England, France, and Germany there are many splendid works of art which have never been photographed and are therefore not readily accessible to students, who are almost always largely dependent upon nearly complete collections of photographs The first series of reproductions of the society has appeared.

At last the famous Borgia apartments of the Vatican have been opened. The six galleries with frescoes by Pinturicchio, which have hitherto formed a part of the Vatican library, and have been piled with books to a great height, have now been cleared out, and the beautiful mural decorative paintings can now be seen. There are few places in the world where the student can receive more instructive lessons in pure decoration. Many of the paintings include contemporaries of Pinturicchio, including Lucretia Borgia pictured as a saint —Saint Catherine! For many years access to the Borgia apartments was only obtained through the greatest difficulty. Permissions were only possible through the aid of powerful introductions. When the apartments were opened a throne had been prepared for the Pope in each room, and here he sat and listened with deepest interest to the history of the various frescoes by one of the most learned cardinals of the Sacred College, and afterward by the chief curator of the Pontifical Museum. The frescoes have been restored in a conservative manner.

The Bicycle and Tuberculosis in Women.

At the last quarterly meeting of the American Statistical Association, Dr. S. W. Abbott, secretary of the Massachusetts Board of Health, presented some interesting figures regarding the proportion of pulmonary tuberculosis in females to that in males in Massachusetts. The rate in 1851 was 1,451 females to 1,000 males; in 1890, 1,055 females to 1,000 males; and last year only 974 females to 1,000 males. Last year was the first in the history of the State in which the number of deaths from phthisis in females was smaller than that in males. The fact that a uniform reduction in the rate of female deaths began some five years ago, about the time when women were beginning to ride the bicycle extensively, Dr. Abbott considers significant, and he is inclined to attribute the decrease in the death rate to the great increase in open air exercise among women which has been inaugurated by the use of the bicycle.—**British Medical and Surgical Journal.**

Science Notes.

Norway's Storthing has voted a lump sum of 4,000 kroner, $1,080, each to Nansen's twelve companions and 3,000 kroner a year for five years to Captain Svendrup, who is to command the next expedition in the Fram, planned for 1898.

The final selection of the plans for the statue of Von Helmholtz has not as yet been made, but the plans submitted by the sculptors Lessing, Hertert, and Janensch have been selected from those submitted and these designs have been exhibited in Berlin. The statue will be placed in the court of the university.

The firm of Frederich Bayer & Company, of Elberfeld, Germany, has purchased the entire library of the late Professor Kukulé consisting of 18,000 volumes and said to be the most complete collection of chemical works in existence. It is to such things as this that Germany owes her wonderful position in the industrial arts.

Prof. Elmer Gates, of Washington, claims to have produced an absolutely perfect vacuum by filling a very infusible test tube with a glass melting at a much lower temperature. Then by inverting the test tube and partially withdrawing the molten glass by suction, a space was left which, when the glass had solidified, was claimed to be perfectly vacuous.

The Italian electrical journal L'Elettricista contains an article by Prof. Mosso and Mr. Ottolenghi, in which they describe their researches made to test the poisonous action of acetylene on various animals, such as dogs, birds, frogs, and rats, etc. They found it to be a strong poison. A small quantity in the air or inoculated in the blood is followed by death, and even when the animals are resuscitated with fresh air before death, they die afterward. A mixture of 20 per cent of acetylene in the air is followed by death in one hour.

The shelless limpet pulls 1,984 times its own weight when in the air, and about double when measured in the water. Fleas pull 1,493 times their own dead weight. The Mediterranean cockle, Venus verrucosa, can exert a pulling power equal to 2,071 times the weight of its own body. So great is the power possessed by the oyster, that to open it a force equal to 1319·5 times the weight of its shelless body is required. If the human being possessed strength as great in proportion as that of these shell fish, the average man would be able to lift the enormous weight of 2,976,000 pounds, pulling in the same degree as the limpet. And if the man pulled in the same proportionate degree as the cockle, he would sustain 3,106,500 pounds.

Some six years ago M. Vallot erected on Mont Blanc, 1,400 feet from the summit, or 14,381 feet above sea level, the highest meteorological observatory in Europe. Having made twenty-one or more ascents of the mountain, and obtained observations during three successive summers, he now generously offers the use not only of laboratory and instruments, but of kitchen and salon to meteorologists of any nation who care to pursue their investigations amid such exalted surroundings. Intending visitors are advised to provide themselves with a somewhat substantial smelling bottle in the form of a steel tube filled with compressed oxygen, the most approved remedy or specific for mountain sickness being the inhalation of a few quarts of this enlivening element.

The mayor of Ripon, England, recently announced that anyone giving evidence in the county court might, if he wished, be sworn in the Scotch form. A new copy of the Gospels was also presented to the court, and it was suggested, says the Lancet, that a bacteriological examination should be made of the cover of the old one, which had been in use for sixty years. The examination was accordingly undertaken by Mr. F. W. Richardson, consulting chemist to the Bradford Corporation. The result showed that, besides various moulds, there were present the micrococcus pyogenes albus and aureus, but it is comforting to know that not one of the specific germs of the communicable diseases was found. Kissing the book is a filthy and useless custom, and the Scotch form of oath taking is, as has been over and over again insisted upon, infinitely preferable from every point of view.

Charles Burckhalter, the astronomer of the Chabot Observatory, will travel half way around the world so that for two minutes in far-off India he may endeavor to photograph the sun during the solar eclipse of next January. As the eclipse during totality will be observable only in India, many scientists will travel thither to make observations. Charles Burckhalter has obtained considerable prominence by his discovery of a new method of photographing the sun during an eclipse, which gives results that are of the greatest scientific interest. To give him an opportunity to apply his discovery, a number of wealthy San Franciscans, who wanted to add something to the cause of science, sent the astronomer to Japan during the eclipse observable there some time since. The day on which the eclipse occurred was cloudy and no photograph could be secured. The same friends of science have offered to pay the expenses of a trip for Mr. Burckhalter to India. Mr. Burckhalter has determined that if he goes to India his party shall be known as the Chabot Observatory expedition, so that the little Oakland observatory will be prominent in the scientific world.

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Recent Patent and Trade Mark Decisions.

Clune v. Madden (U. S. C. C., Ind.), 77 Fed., 205.

Folding Bed Lounges.—The Clune patent, No. 294,957, has been held invalid as to claim 1 for lack of invention.

Invention.—There is no invention in the use of a pin or hook on the back of a folding bed lounge to automatically engage the eye on the head rest when the two sections are folded together, thus holding the back firmly in place.

Schenck v. Diamond Match Company (U. S. C. C. A., 3d Cir.), 77 Fed., 208.

Friction Match Device. — The Pusey patent, No. 483,166, for a friction match device to be carried in the pocket, has been held valid and infringed, it seeming to show invention, and, while so simple, it was new in the art, cheap and convenient and supplied a distinctly felt want.

Williams v. Breitling Manufacturing Company (U. S. C. C. A., 7th Cir.), 77 Fed., 285.

Preliminary Injunction.—A preliminary injunction should be denied, though substantial similarity between the two devices is conceded, where the patent is attacked for want of novelty and invention, when there has been no adjudication sustaining it and where there is no showing of defendant's inability to respond in damages.

Westinghouse Air Brake Company v. Burton Stock Car Company (U. S. C. C. A., 1st Cir.), 77 Fed., 301.

Preliminary Injunction.—It is within the discretion of the court to refuse a preliminary injunction, although the patent has been sustained, and infringement declared by another court, where there is possibility of grave and indefinite injury to the defendant who was a mere user, in case the final decisions were in his favor, but in such case the defendant must give an ample bond for damages.

Lublin v. Stewart, Howe & May Company (U. S. C. C. A., 3d Cir.), 77 Fed., 303.

Dress Stays.—The Bray patent, No. 440,246, has been held valid and the decision of the lower court reversed on the ground that it was not anticipated by the Curtis patent, No. 243,519, as the two devices consist of radically different combinations and accomplish palpably diverse ends.

McKay & Copeland Lasting Machine Company v. Copeland Rapid Laster Manufacturing Company (U. S. C. C. of Maine), 77 Fed., 306.

Patent on Unused Device.—The mere fact that the patented device has never been put to any continued successful commercial use is not sufficient to overcome the prima facie case made by the patent. There must be a patentable difference between claims in the same patent, and where a third claim in the patent differs from the first claim only in adding an element which contributes no more to the novelty of the combination than would the floor or block on which the machine rests, such third claim is void as mere surplusage.

Machine for Flanging Counters of Boots and Shoes.—The Hulbert & Kennard patent, No. 243,917, has been held void as to the first and third claims.

Smertz v. Appert (Commissioner's Decision), 77 O. G., 1784.

Affidavit to Overcome Foreign Patent.—A holding that the applicant has not presented an affidavit sufficient to overcome a foreign patent is not pleadable to the commissioner, because it does not relate to the merits of the case. Such affidavit should contain not only the deponent's conclusion that he was the first inventor, but should state the facts, and the facts only that support such conclusion. Such affidavit may be aided by the preliminary statement in the interference. Where an application becomes involved and motion is made to dissolve the same on the ground that one of the applicants had not under the rules overcome a French patent, the party is entitled to invoke the doctrine of priority of mere conception, and even though he can show nothing but mental acts prior to the reference sought to be overcome, the office must consider whether his conception was sufficiently clear and distinct and whether under the circumstances his progress was marked by due diligence, and this can only be done upon full record of the case and not upon preliminary motion.

Sixty Years of Progress.

BY SIR EDWIN ARNOLD.

The forward march of science during the past sixty years has been nothing less than astonishing. Justly did Professor Huxley call the Victorian period "a revolution of modern minds." Out of the love of knowledge pursued with single hearts before the reign, or at its commencement, by Herschel and Laplace, Young, Fresnel, Cavendish, Lamarck, Davy, Jussieu, Cuvier, Decandolle, Faraday, Tyndall, Darwin, and their like, there sprang up under this reign the fruit of countless rich practical applications. Three achievements in physical philosophy alone have been sufficient to immortalize the reign—the scientific doctrines, first, of the molecular constitution of matter; secondly, of the conservation of energy; thirdly, of evolution as divined by Darwin.

That last illustrious name shines of itself like a lonely star of glory, sufficient to make resplendent the Victorian constellation of talent. But consider how, practically, all our electrical developments also lie inside this period; with well-nigh all the marvelous utilization of steam on sea and land; almost all the amazing improvements in mechanical, industrial machinery; almost all the discoveries in hygienic matters; together with vast advances in chemistry, metallurgy, astronomy, physiology, and, we may add, geography, geology, and biology. Only to mention the spectroscope, the camera, the microphone, the phonograph, the telephone, and the kinetoscope—alluded to above—is to use words never heard sixty years ago, though now so familiar. One discovery, as is the wont of Nature, helps to lead to another. The exquisite experiments of Tyndall illuminating floating motes aided Lister to introduce antiseptic surgery and to abolish hospital gangrene. There are those, it is true, like the late Professor Huxley, who resent the idea of utilitarian science. He has said:

"That which stirs the pulses of the votaries of science is the love of knowledge, and the joy of the discovery of the 'causes of things,' the supreme delight of extending the realm of law and order ever farther and farther. In the course of this work, the physical philosopher, sometimes intentionally, but more often unintentionally, lights upon something which proves to be of practical value. Great is the rejoicing of all who are benefited thereby, and for the moment Science is the Diana of all these Ephesian craftsmen. But even while this flotsam and jetsam of investigation is being turned into wages of workmen and wealth of capitalists the crest of the wave of scientific inquiry is far away on its course over the illimitable ocean of the unknown."

The cynicism latent in this may be forgiven for the sake of its fine intellectual pride and noble passion for Truth, but I am of those who think Truth herself fairest when she is most beneficent, helpful and generous. With this view I hail, as specially and gloriously commemorative of the Queen's sixty years, the benign extensions of the arts of remedial surgery and medicine during its progress, and particularly the two arch events of the introduction of anæsthetics and of female nursing as a study and profession. From the sanguinary fields of the Crimean war arose, like an angel of compassion and redemption, Florence Nightingale, with all that train of skilled and gentle women, afterward following her excellent example, who have altered the history of the sick room and regenerated our hospitals. Lister's antiseptic treatment of wounds, already spoken of, founded on the information obtained by Tyndall's electric beam and the microscope, and such experiments as Pasteur's about infinitesimal life, have stripped surgical operations of their previous deadly peril by reason of septic organisms, while—as if Science designed to bestow a specially appropriate boon on the youthful and compassionate Queen—Simpson in Edinburgh, simultaneously with Wells and Morton in the United States, early in her Victorian age performed those merciful experiments with chloroform which terminated the epoch of unavoidable anguish for sick and wounded patients, robbed even war of its worst features, and commenced the present blessed era of anæsthetics. Read what a renowned surgeon, Mr. Brudenell Carter, writes about that happy discovery:

"The use of anæsthetics has changed the whole aspect of surgery. Prior to 1847, operations were few in number, and were almost limited to the amputation of limbs, the removal of cancerous and other tumors, the resection of a few of the larger joints, cutting for stone, and the ligature of main arteries for aneurism. The pain suffered by the patients was so horrible as to tax severely the endurance of the bravest and strongest, and to depress seriously and often beyond recall the powers of life. Death from shock was by no means uncommon, the patient sinking in a few hours from the effects of the suffering which he had undergone. The writer well remembers, as a medical student, turning sick and faint at the agonies which he was called upon to witness; and it was a point of honor with operators in those days to abbreviate such agonies as much as possible, and to cultivate speed in operating as the highest and the most valuable form of dexterity. Nothing was attempted which could not be done quickly, and an amputation in the hands of a practiced surgeon had almost the appearance of a feat of legerdemain. For the separation of the lower limb above the knee—of course, not including dressing—twenty seconds has been known to suffice, and forty seconds was regarded as a period of time which no one was justified in exceeding. When anæsthetics were employed, it came to surgeons as a kind of revelation that they need no longer be in haste, and they have utilized that knowledge in making leisurely examination and safe procedure."

I am almost more grateful for the tardy arrival of this anæsthetic revolution in the train of her gracious majesty than for railways, steamships, and electric telegraphs, for the great armies and navies, for vast expansions of imperial territory, and even education, photography, constitutional liberties, or anything else. It was so strange, so tantalizing to a lover of his kind, that what Humphry Davy had so long before noted and imparted about nitrous oxide should pass unnoticed and unapplied. The key was already there, but not until many years afterward did an almost casual hand (that of an American dentist) fit it into the golden door behind which sat waiting an angel of pity, kinder and more powerful than any Arabian fairy suddenly revealed in her divine beauty and bountifulness to any prince or magician of the "Thousand and One Nights." Before now I have asked whether there is anything anywhere in human history which more sternly teaches that man must win every boon of Nature by his own ceaseless striving than the fact that this simple chemical and physiological secret of chloroform should have lurked so long in its easy formula, undeciphered through all those waiting generations when Pain was an omnipresent tyrant whom Science could not control, and the operating room a torture chamber, dreaded almost as much by the surgeon as by the sufferer. Think of those gallant sailors of Nelson at Trafalgar, whose bleeding stumps, in the gloom of the orlop deck, were plunged into hot pitch to stay the hemorrhage!

One would almost expect that, out of pity toward such brave men, and for the sake of the countless tender women and children who, age after age, so hopelessly endured their anguish, Nature herself would have burst her iron law of impassive silence, and, as Helen did in the Odyssey for the sorely tried Greeks, have poured this pitying nepenthe into the bitter cup of mortal life. Not until 1847, however—although Davy had been so very near the revelation in 1839—did the anæsthetic age commence, giving to surgical art a sure control of agony, to its boldest practices confidence, quiet, and leisure, and to those who are constrained to come under that knife a sweet and complete oblivion. I have myself known what it is to pass, fearless of the kind steel, into that world of black, velvetlike tranquillity, of which these magic drugs now keep the gate, and to awake as good as healed, grateful beyond words for the soft spell of enchanted peace and the sure and faithful skill. This unspeakably good gift to mankind was of the American dentist's and of Sir James Simpson's giving, a participated glory of the reign, like that of the new school of nursing, which has wrought so much benefit and created a fresh vocation for many a young woman's gentle energies. In 1837 there was no proper nursing. There were Mrs. Gamp and Mrs. Betsy Prig, or else heavy-handed and heavy-footed male attendants, rudely different in mind, manner, and influence from the lightly moving and soft-speaking females whose trained intelligence and care now smooth every sick pillow, and faithfully discharge the ordinances of the doctor. There is no doubt the change was primarily due to the example of Miss Florence Nightingale—one of the glories of the reign—who went, at the head of a band of nurses—many among them of high birth—to the Crimean hospitals, and by demonstrating there, and afterward, the boundless advantages of skilled and first-class nursing, gave to the Victorian age the advantages of this modern system, and to a large number of her sex a new, suitable, and most honorable vocation.—Daily Telegraph.

Formation of Crystals in Cadavers.

Some work on the sewers done in Bearn Street, Paris, last August, brought to light two leaden coffins, which were found upon the site of an ancient church connected with the Convent of the Minimes. They date back to 1630. These coffins having been carried to the Carnavalet Museum, it was discovered that the bones that they contained were covered with white crystalline spangles. In one of them especially the cavity of the skull was converted into a magnificent geode, strewed with white needle-shaped crystals arranged in clusters and having a length of over a quarter of an inch. Mr. Lacroix, in a communication to the French Academy of Sciences, showed that these crystals were formed by a hydrated phosphate of lime allied to the metabrushite of mineralogists. The perfect tightness of the coffins showed that these crystals were formed at the expense of the cadavers exclusively and that we have here a case of autoimineralization. It was the bones that furnished the lime and doubtless also a portion of the phosphoric acid. The decomposition of the brain must likewise have furnished phosphoric acid, as the majority of the crystals were found upon the internal surface of the skull, and those of the exterior were almost all situated along the fissures of the latter.

Let us remark, by the way, that brushite and metabrushite, which the crystals under consideration resemble, are two substances found in deposits of guano, and must be of organic origin. In the grotto of Minerva (Aude), Mr. Armand has observed a curious layer of brushite associated with an aluminous phosphate. As this layer was strewed with bones, Mr. Armand suspects that it was due to the decomposition of soft organs that belonged to the animals whose skeletons were found above. The preceding interpretation is thus perfectly confirmed.—Revue Larousse.

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NEW STEEL ARCH BRIDGE OVER THE NIAGARA.

BY ORRIN E. DUNLAP.

On Sunday, March 28, the last panel of the great new steel arch bridge across the Niagara gorge was put in place and the arch proper finished. This new arch is being built to replace the old railway suspension bridge, which for so many years has been used by the Grand Trunk Railway. When completed it will compare most favorably with the bridges of its class in this country and Europe. Work was commenced late last fall, and has proceeded throughout the winter without loss of life or serious accident. Preparatory to the erection of the steel, the abutments of masonry were constructed on either side of the river. These abutments are four in number, two on each side of the gorge. At first it was proposed to locate them on the stratum of Clinton limestone, but this was found impossible on the Canadian side, where a foundation of concrete was built. On the New York State side, however, the abutments rest on the limestone. On both sides of the river they are located about midway between the water's edge and the top of the cliff. The stone for the Canadian abutments was obtained in the Queenston, Ont., quarries, and that for the New York State abutments at Chaumont, Jefferson County, N. Y. The abutments are magnificent samples of masonry.

It will be seen from the illustration that the arch as it spans the gorge is most graceful in proportions. It is the first bridge of its kind to be sprung across the Niagara chasm, and its erection has attracted much attention. The length of the main span of the arch is 550 feet between the centers of the end pins. This span is connected to the cliff on either side by a trussed span 115 feet in length. One end of each shore span is hinged to the arch by a pin at the intersection of the end post and top chord of the arch, while the shore end rests on expansion rollers, which in turn rest on the masonry abutments above referred to.

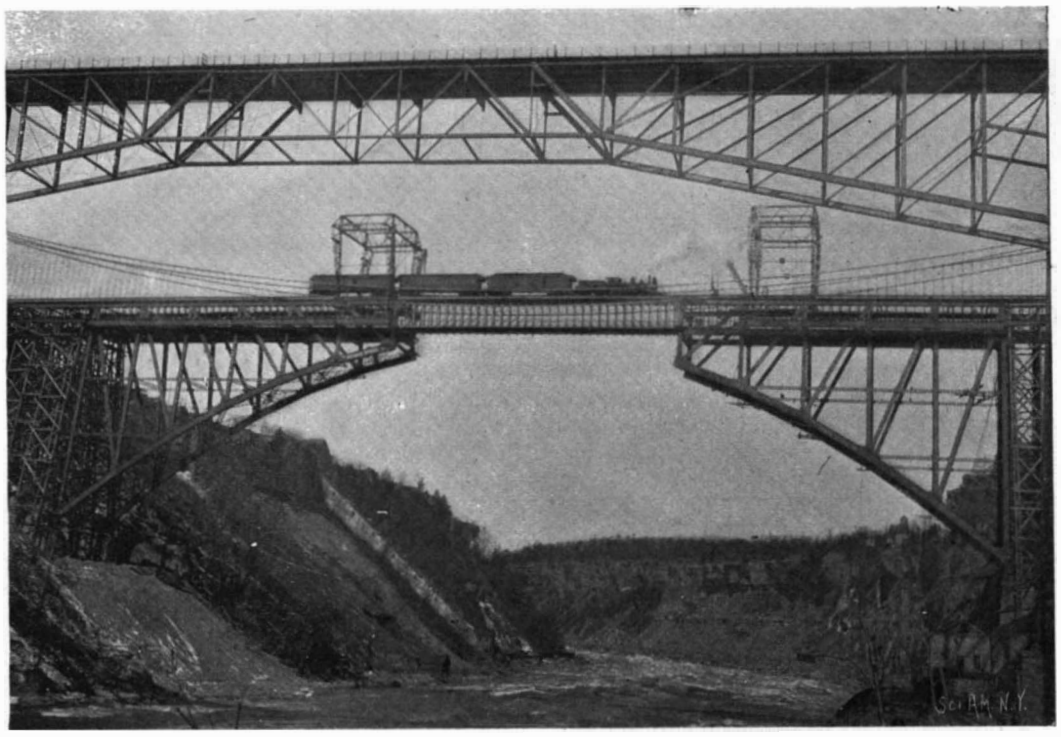
The new arch will have two floors or decks. The upper floor will carry the steam railroad tracks, and the lower one the carriageway, sidewalks and trolley track. The present suspension bridge has but a single track on its upper deck for railway purposes, whereas the arch will be double tracked on its upper deck, thus giving greatly increased facilities to the railroads using it. Resting on the upper chords of the arch, above each post, there will be transverse steel beams, and between these beams will be four lines of longitudinal steel stringers placed 7 feet apart and directly under the railroad tracks. The lower deck will be formed by four lines of longitudinal steel stringers, placed about 11 feet apart, and transverse beams. The I beams which will be placed across the stringers will extend beyond the trusses to carry the sidewalks. It is on this floor that the trolley track is to be laid, and it will be the first trolley track to cross the chasm. It is altogether likely that the first trolley car to pass from the United States into the Dominion of Canada on its own wheels and by its own power will cross this structure. The carriageway and trolley track will be planked with oak plank, and the sidewalks will be a few inches above the carriageway.

All told, there will be in the arch when completed over 6,000,000 pounds of steel. Of this amount it is estimated that there will be about 5,560,000 pounds of steel plates and angles, 218,000 pounds of steel castings, 182,143 pounds of eye bars and pins, and about 30,000 pounds of wrought iron rods, etc. As the great incentive to the construction of the arch was to secure increased facilities for crossing the gorge, it may be imagined that the bridge is designed to carry a very heavy load both on the upper and the lower decks. It is expected that the arch will carry on each railroad track two locomotives with four pairs of drivers each and 40,000 pounds on each driver. This to be followed by a train having a weight of 3,500 pounds per foot. In addition to this it is designed to support a load of 3,000 pounds per running foot on the lower floor, all making an exceedingly heavy load.

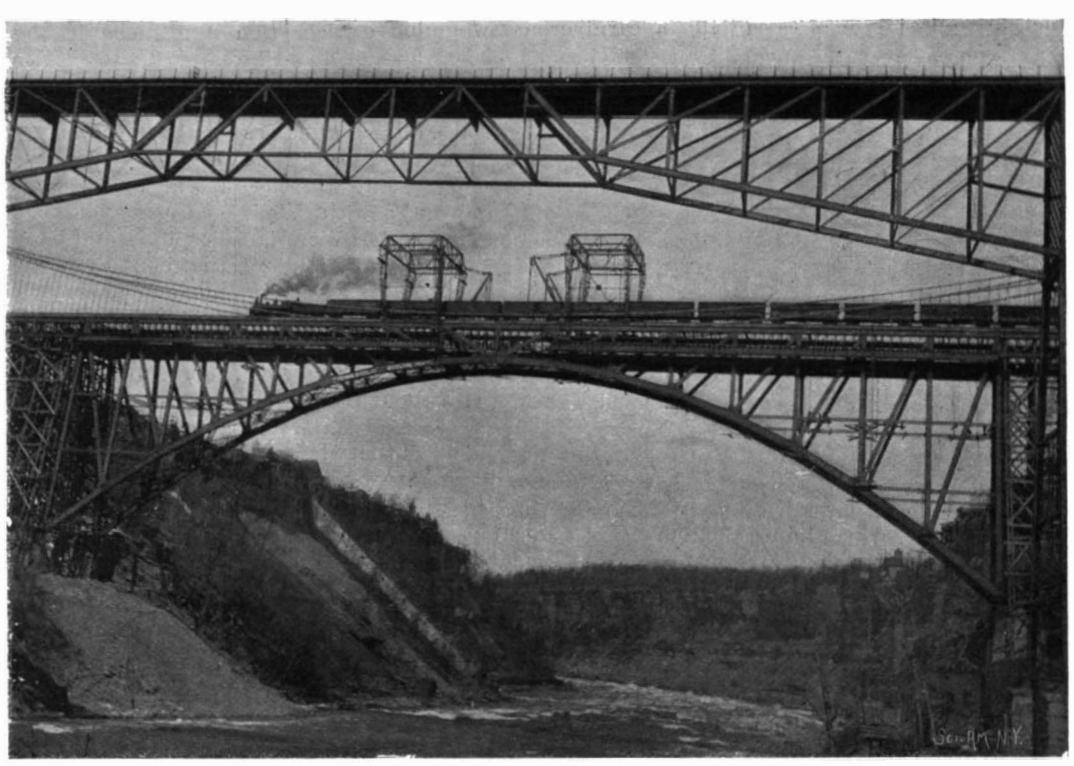
In the construction of the arch the end spans and the first panels were erected on scaffolding built between the abutments and the cliff on each side of the river, a portion of this scaffolding being visible in the illustration given herewith. During all the time the arch has been in building the old suspension bridge has been in constant use, despite the fact that the arch has been built beneath and about it, practically on its very site. This called for the display of rare engineering skill, and extreme accuracy in the length of all the pieces of steel that entered the arch. However, the engineer in charge of the work was Mr. L. L. Buck, who is the chief engineer of the Niagara Falls International Bridge Company and the Niagara Falls Suspension Bridge Company, owners of the bridge, and this is not the first time his rare abilities as an engineer have been called into play by the Niagara gorge and its bridges. The old railway suspension bridge was completed in 1855, having been commenced in 1848. As first erected it was of wood, the towers being of stone. In 1880 the suspended structure was renewed in steel, and in 1886 the stone towers gave way to new ones of steel. All this difficult work of renewal was done under Mr. Buck's supervision, without the least interruption to the regular traffic on the bridge. As the new arch is designed to take the place of the railway suspension bridge, the latter structure will soon be taken down and removed. When this is done one of the oldest and best known landmarks on the Niagara frontier will disappear. It was owing to the location of the suspension bridge in 1848 that the town of Bellevue changed its name to Suspension Bridge, this village having been merged into the city of Niagara Falls in 1892, but the old name, "Suspension Bridge," still sticks to the place, and the railroads continue to carry it on all their printed matter. The railway suspension bridge was the first great bridge of its kind to be erected in the United States, and its passing is of more than local interest. The dimensions of the new arch will be best understood by comparison with other great arches of the world, the dimensions of which are as follows:

	Span.	Rise.
Louis I, Oporto, Portugal	566	146
Garabit, France	543	170
Pia Maria, Portugal	525	121
Washington Bridge, New York	510	91·7
Eads St. Louis Bridge	520	47
Paderno, Italy	492	123
Rochester Park	428	67

The contract for the erection of the arch is held by the Pennsylvania Steel Company, of Steelton, Pa., and they expect to have the bridge completed and the old bridge removed some time in June.



VIEW SHOWING OLD SUSPENSION BRIDGE AND NEW BRIDGE UNCOMPLETED.



NEW STEEL ARCH BRIDGE OVER NIAGARA RIVER.

Deepest Bore Hole in the World.

The deepest bore hole in the world, says Mr. C. Zundel, in a late communication to the Industrial Society of Mulhouse, is one of 6,571 feet below the surface of the soil, made at Parnschowitz, near Rybrick, Upper Silesia. The previous record for depth was the 5,733 foot hole drilled some years ago at Schladebach, near Leipzig. The later bore hole was made in a search for coal measures, and 83 separate seams, some of considerable thickness, were penetrated. The hole was 12 inches in diameter at the beginning and this was lined with a tube about 0·4 inch thick; at a depth of 230 feet the bore was reduced to 8¼ inches diameter, and thus continued for 351 feet. At this point the blue marl encountered became so compact that the diamond drill had to be used, and under the action of the water the marl swelled to such a degree that the diameter of the pipe had to be again reduced. The greatest difficulty encountered was the great weight of the boring rods, as the depth increased. Though steel was used, at a depth of 6,560 feet the total weight of the tools reached 30,155 pounds. Under this weight ruptures of the rods were frequent, and an accident of this nature finally stopped the work; about 4,500 feet of rods fell to the bottom, and, being jammed under a part of the tubing, it was impossible to withdraw it. The diameter of the well at the bottom was 2¾ inches. Temperature observations made showed 12 C., or 53·6° Fah., at the surface, and at the depth of 6,571 feet the temperature reached 69·3° C., or 157° Fah. This is equivalent to an average augmentation of heat of 1° C. for every 34·14 m. of depth, or 1° Fah. for every 63 feet. These figures differ slightly from those obtained in other deep borings. The increase of heat at Schladebach corresponded to 1° C. in 35·45 m.; that at Sperenberg, near Berlin, to 1° C. in 32·51 m.; and at the artesian well of Grenelle, at Paris, which is only 1,797 feet deep and furnishes water at a temperature of 27·70° C., it is estimated that the increase of heat is equivalent to 1° C. in 31·83 m. The boring at Parnschowitz was commenced on March 26, 1892, and it reached its maximum depth on May 17, 1893, or in 399 working days. The total cost was $18,800, or about $2.86 per lineal foot.

THE recent observations of Perrotin at Nice (France), and of Lowell at Flagstaff, Arizona, says Prometheus, have confirmed the theory that Venus and Mercury revolve on their axes like the moon; that is, the periods of rotation and revolution are identical. Herr Brenner's alleged discovery of a short time of rotation for Venus (about twenty-four hours) therefore proves a fallacy. According to Lowell, Venus is not veiled by clouds, but by a dense atmosphere.

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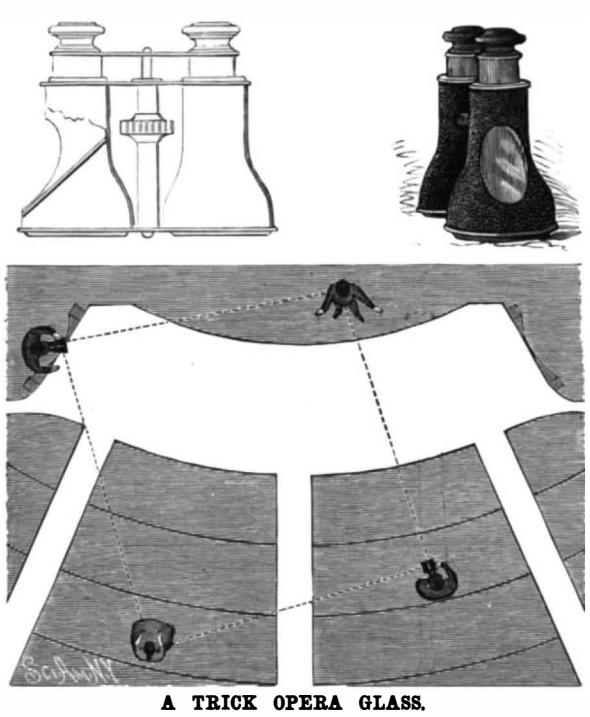
CROSSING THE CATARACT OF TEQUENDAMA ON A ROPE.

The plain of Bogota is sixty miles long from north to south and thirty miles wide from east to west. It is intersected by verdant prairies and dense woods, affording some ornamental and many useful species of timber. The river Funga, formed by numerous mountain streams which take their rise one hundred miles north of the city, traverses the plain in a southwesterly direction to Tequendama, where, through a gap not over 36 feet in width, it leaps over a rocky ledge upward of 600 feet high, forming one of the most magnificent cataracts on the globe, and thence rushes down to join the Magdalena. The height of this precipice is so great that the inhabitants of Bogota were terrified by the daring and audacious act of the Canadian equilibrist, Mr. Warner, who, in November, crossed the abyss of the Tequendama in imitation of the act of Blondin at Niagara. This feat is shown in the accompanying engravings, which are reproductions of photographs taken on the spot by A. Esperm, of the city of Bogota, which have been sent to us by Mr. Harry Warner.

From the remotest antiquity there have always been equilibrists, many of whom were extraordinarily daring and skillful, and have astounded the spectators by their deeds of prowess. History tells us that, in 1385, upon the entrance of Isabel of Bavaria into Paris, a Genoese allowed himself to slide, singing, from the tops of the towers of Notre Dame to the Pont de Change, over which the queen passed and entered through an opening in the blue taffeta sown with golden fleur de lis with which the bridge was covered. After having placed a crown on young Isabel's head, the equilibrist continued his aerial journey. When it was nearly night, the Genoese ascended to the towers carrying a lighted torch in each hand, which must have caused a singular appearance from a distance and doubtless gave rise to more than one story of fantastic apparitions. If history has preserved for us through five centuries the tradition of this descent from the towers of Notre Dame to the Pont de Change as a marvelous feat, what can we say of Blondin and his imitators, especially of Warner, who has dared not only on a wire to cross the cataract of Niagara, but has just performed the wonderful feat of crossing the terrible abyss of Tequendama on a rope. The crossing of Niagara gave Blondin a universal reputation, he being the first to try this daring act; but if considered conscientiously, that is nothing compared with the crossing of Tequendama, for the conditions of the two cataracts are quite different. At Niagara an acrobat who became dizzy and lost his equilibrium would fall into waters that are perfectly tranquil and very deep—circumstances which, taken in connection with the fact that the fall would not be more than about one hundred feet, would give the equilibrist the assurance of salvation, for he would not encounter rocks, and, if he knew something of



A TRICK OPERA GLASS.

swimming, he would rise to the surface and swim to one of the banks or to a boat which would pick him up and land him safely. At Tequendama all the conditions of the abyss are against the equilibrist, who, in case he experiences the slightest dizziness and falls, would be very certain of breaking his neck, for he would fall into a raging torrent from the terrible height of 479 feet! What would be the size of the largest fragment of the acrobat that could be picked up at the bottom of such an abyss?

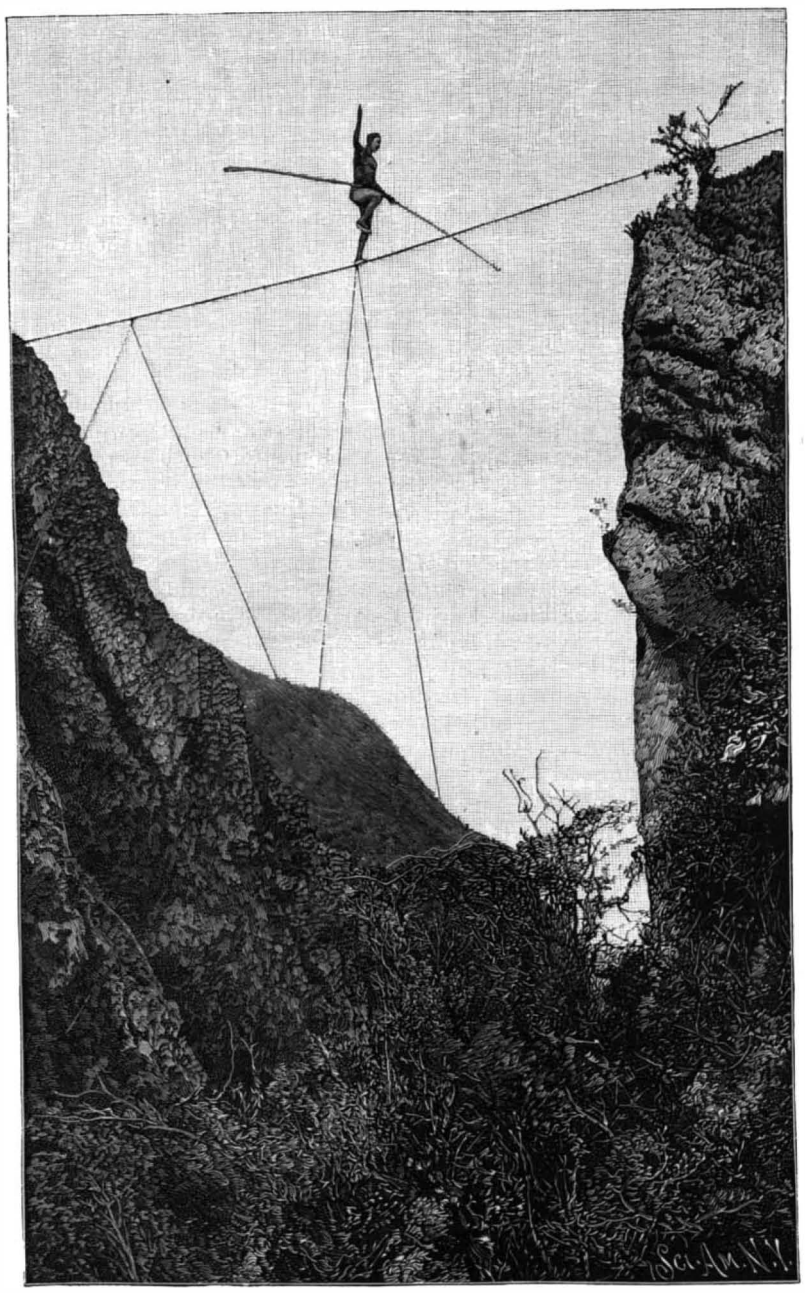
PROF. O. C. MARSH, in a short paper in the American Journal of Science, calls attention to the fact that some sixteen years ago he pronounced the remains of a large swimming bird found in Kansas ten years before to be those of essentially a carnivorous swimming ostrich. His conclusions were combated by scientific critics, and he now announces, as confirming them, the discovery in the same region of a remarkably perfect specimen of the bird, with feathers in place, and those feathers the typical plumage of the ostrich.

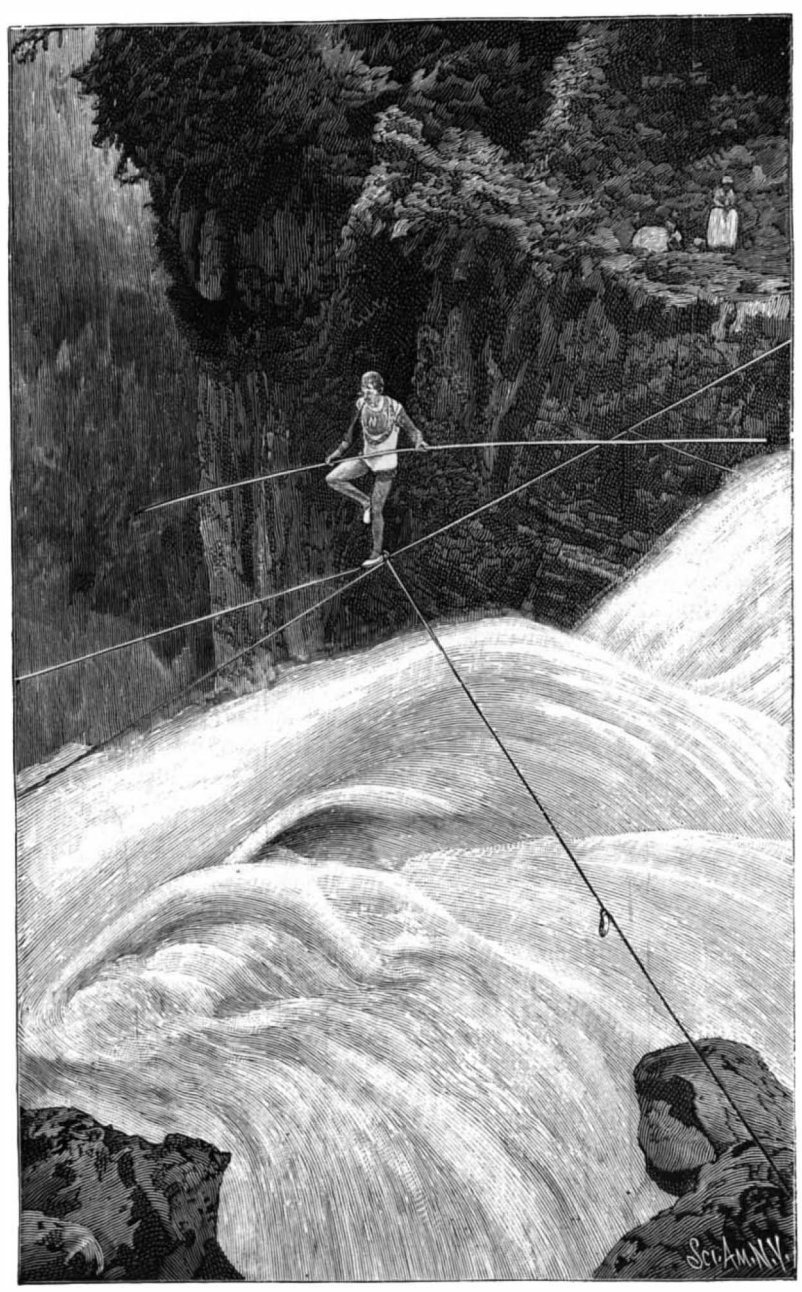
A TRICK OPERA GLASS.

We present an engraving of a trick opera glass which may be new to some of our readers, although the principle involved is very old. One tube of the opera glass is constructed in the ordinary manner, being provided with lenses, while the other tube is arranged to give a view of any object at right angles to the line of vision of the normal tube, or considerably to the rear of it. The trick tube has no eyepiece and the objective is done away with, a piece of japanned wood taking its place. A portion of the tube and its leather cover is cut away and a mirror is inserted at an angle in the tube. When the observer wishes to use the trick glass at short range, he covers up a portion of the opening in the tube with his fingers, but at longer range this precaution would not be necessary. The practical uses of the glass are apparent. Our engraving shows a plan view of a theater, with the stage, boxes, and seats. The gentlemen in the box and the one on the right of the center aisle both appear to be observing the actor on the stage, but in reality they are observing the lady on the left of the center aisle. Of course each of the gentlemen has his glasses turned a different way around.

Changes in the Blood after Thyroidectomy.

Dr. Postoeff, of Kharkoff, has made a number of observations on the blood of dogs before and after the removal of the thyroid gland, with the object of elucidating the changes which the extirpation of the gland produces in the blood. He divides the theories which have been propounded on this subject into two groups—the one supposing that the thyroid gland in its normal condition secretes some substance which is necessary to the proper working of the nervous system, and the other ascribing to the gland the secretion of some substance which directly destroys certain metabolic products, the accumulation of which in the blood would be fatal. His observations show that the extirpation of the thyroid gland is followed by a diminution in the red corpuscles, the hemoglobin, and the specific gravity of the blood; an increase in the white corpuscles; a great increase in the fibrin obtained by whipping the blood; a diminution of nitrogen both in the blood and in the serum; and a marked diminution of nitrogen in the fibrin, not only relative, but absolute.—Lancet.





CROSSING THE TEQUENDAMA CATARACT, VENEZUELA, ON A TIGHT ROPE.

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DEATH OF PROF. COPE.

Prof. Edward Drinker Cope, Ph.D., died at his Philadelphia home April 12. He was professor of zoology and comparative anatomy in the school of biology at the University of Pennsylvania. In the death of Prof. Cope America has lost one of her greatest men of science; a man of world-wide reputation. He was born in Philadelphia in 1840 and studied medicine in the University of Pennsylvania and comparative anatomy at the Philadelphia Academy of Sciences. In 1859 he joined the group of young naturalists who were associated together in the Smithsonian Institution under Prof. Baird. In 1863 he went abroad to study in the universities of Europe. He returned in 1864 to accept the chair of natural science in Haverford College. He resigned this place three years later, becoming palæontologist to the government Geological Survey. His work in this connection has resulted in the discovery of more than one thousand new species of extinct and as many recent vertebrata. Prof. Cope's range, like that of Cuvier, extended from the lowest vertebrates to man and from the dawn of the vertebrate life in the remote palæozoic fishes to evolution in the contemporary races of man. For a while his studies were parallel with those of Leidy and Marsh, but, fortunately for science, they all soon took up different branches of the field. The monumental researches of Prof. Cope were published by the government. Only Part I of the very bulky Tertiary Vertebrata has been published. The plates and preliminary manuscript for Part II are ready. It was Prof. Cope's intention to devote the coming year to their completion. His palæontological studies were thus practically cut in two by his untimely death.

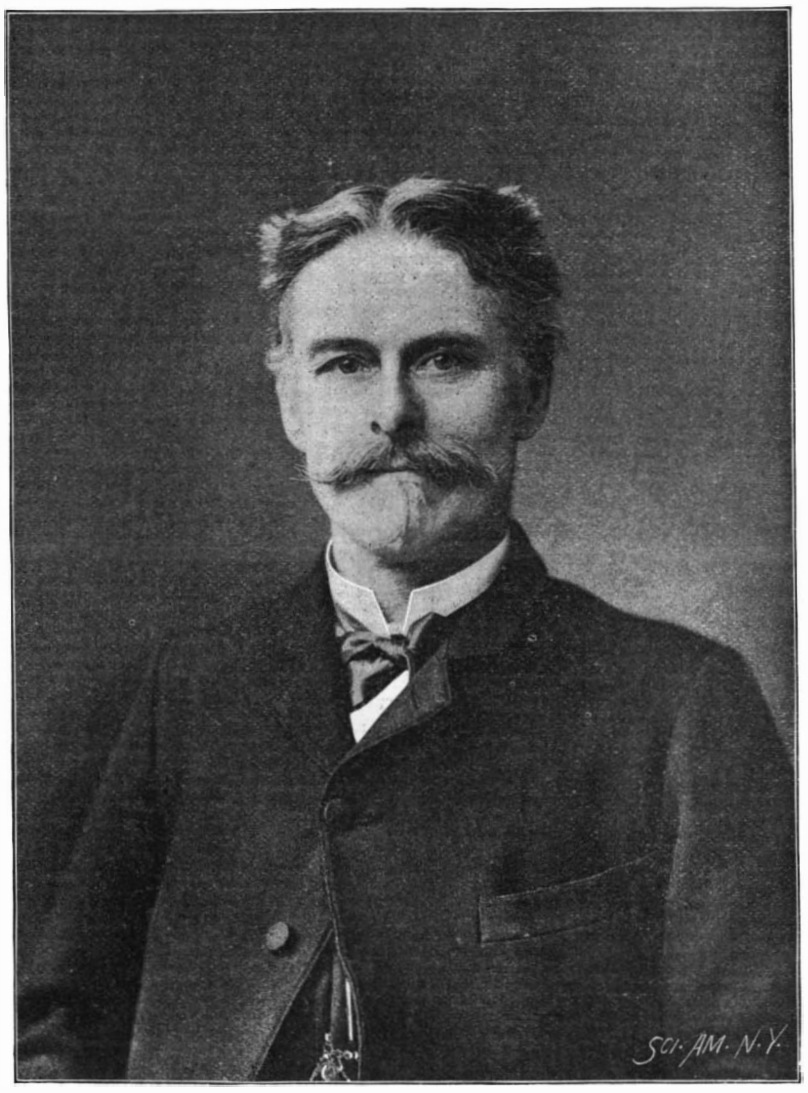
In zoology his investigations were no less important, and include equally striking proofs of his genius as a comparative anatomist.

Prof. Cope is widely known as the leader of the Neo-Lamarckian school in this country, and it is noteworthy that in this sphere he has shown many of the brilliant qualities which characterize the great French predecessor of Darwin. In the preface of his first collected essays, "The Origin of the Fittest," Prof. Cope says that the important point is not only the survival, but the origin of the fitness, and this he traces to the inheritance of the individual reaction to environment. The essays by Weismann in 1882 upon such inheritance do not discredit Prof. Cope's statements, he simply resting upon facts of palæontology as demonstrating the actuality of such transmission, and has proposed a purely hypothetical heredity theory of his own, entitled "Diplogenesis."

Prof. Cope was the chief editor of the American Naturalist, which occupies an enviable position among the periodicals of the world which are devoted to pure science and natural history.

In his Philadelphia home he had a wonderful collection of specimens of all kinds. The titles of his papers number upward of three hundred and fifty, and form a systematic record of the development of palæontology in the United States. In the SCIENTIFIC AMERICAN of August 22, 1896, a partial list of Prof. Cope's principal papers will be found. The Bigsby gold medal was conferred on him by the Geological Survey of Great Britain in 1879, and his name is on the rolls of many of the scientific societies in this country and abroad, including our own National Academy of Sciences, to which he was admitted in 1872.

He joined the American Association in 1868, and in 1875 was advanced to the grade of fellow. The section on biology made him its presiding officer in 1884, and in the following year he addressed the society on "Catagenesis." In 1895 he was elected president.



THE LATE EDWARD DRINKER COPE.

The Annual Exhibition of the New York Microscopical Society.

The eighteenth annual exhibition of the New York Microscopical Society was held in the American Museum of Natural History, Tuesday evening, April 13.

Three of the large exhibition halls of the museum were devoted to the society's use for the evening, and the great crowd of people present testified to the general interest prevailing in this form of scientific study. The society is an incorporated organization and is now in the twentieth year of its existence. It has for its objects the cultivation and advancement of microscopical science and consists of men and women devoted to or interested in microscopy, this being the only qualification for membership. The idea of diffusing a popular knowledge of the revelations of the microscope developed early in the history of the society, and in February, 1880, was begun the series of annual public exhibitions which has been continued to the present time.

The exhibition was somewhat larger than usual, as there were seventy-five separate exhibits, requiring the use of about one hundred and fifty microscopes for their display. It does not seem to be the aim of the society in these exhibitions to show the progress in microscopy during the preceding year so much as to get together an interesting assemblage of beautiful and wonderfully minute objects for the edification of the vast numbers of people who are not in the habit of looking through a magnifying glass. There is such an infinite variety of available objects that one exhibition need not duplicate another, and it would hardly seem necessary to exhibit vinegar eels and cheese mites year after year, but these particular forms of life attracted as much attention this year as they did last, and probably will be as much sought after next year as ever before. Recent advances however in instruments and methods and newly discovered or rare objects were not absent from the exhibition, and this feature was sufficiently pronounced to render the affair interesting and valuable even to the veteran microscopists. Several firms of microscope makers and dealers displayed their newest forms of microscopes and accessories. One of the microtomes exhibited can be made to cut at one slice a section less than $\frac{1}{603}$ inch thick of an anatomical or botanical preparation. Probably the most elaborate microscope shown was one just made by Fuess, of Berlin, for Miss F. R. M. Hitchcock, of Orange, N. J. It is a large instrument devised especially for the study of thin sections of rocks and minerals. One feature of it is that, besides the usual revolving stage, it has a contrivance for rotating the whole polarized light apparatus independently of the stage and the thin section upon it.

In a dark room at one side of the main exhibition halls, the J. B. Colt Company had a continuous stereopticon exhibition, which was very instructive, as showing something of what could be done with the microscope in connection with an arc light projection apparatus. Living fresh water organisms were shown by means of small aquaria four inches square and an inch and a half thick. These were placed in the stereopticon so that the images of their contents were thrown onto the screen, and the movements of the animals studied by the whole audience at leisure.

All grades of organisms, from the lowest plant to the highest animal, were shown in section, and a glimpse was to be had of the microscopic beauties of the mineral kingdom also. George F. Kunz exhibited a star ruby, showing that the characteristic effect in these gems is produced by some peculiarities in their crystallization, and under another microscope he had an assay button of gold showing over its surface the most delicate fernlike crystal markings. Next to this exhibit was one by W. G. Levison, consisting of twenty-five mounts of minute crystals of various minerals. These mounts are arranged so as to be viewed by reflected light and form most beautiful objects, these minute crystals being sharper and more brilliant than large crystals of the same minerals.

Mention should be made of a series of botanical preparations and microdrawings exhibited by members of the post-graduate, senior and junior classes of the College of Pharmacy of the City of New York. The preparations and drawings were made from studies undertaken during the year, and illustrated, among other things, adulterated opium, true and false cascara, cinchona bark, showing the isolated bast fibers, and mould from a medicinal solution. Another educational exhibit was that made by J. D. Hyatt, assisted by members of the cooking class in Grammar School No. 85. It consisted of sections of wheat, rye, barley, oats and corn, showing the relative amounts of starch and gluten cells in each. The head of a centipede, the musical apparatus of some forms of insects, the head of a moth, with its antennæ, the leg and foot of the honey bee, the wing of a butterfly and the ear of a cricket were objects that attracted much attention and aroused much interest, and even enthusiasm. Certain aquatic plants (Vallisneria spiralis and Nitella) were shown, in the cells of which one could see the circulation of the protoplasmic contents, and another microscope near by revealed for comparison the circulating blood in the vessels of the tail of a common tadpole.

Arguments for purifying and maintaining the purity of our city water supply were forcefully presented by the exhibit of microscopic organisms, of both animal and vegetable origin, obtained from Croton water by K. M. Vogel and Dr. S. E. Jelliffe. A more enjoyable exhibit, however, was that on the same table consisting of several kinds of mould prepared and mounted by Dr. Jelliffe. These were delicate green, brown and white forms of plant life raised from spores which were obtained by exposing plates of proper nutrient material to the atmosphere. The investigations made last summer by the Board of Health into the effects of sunstroke were brought to mind by an exhibit by W. Wettengel, which consisted of a section showing the condition of a normal ganglion nerve cell and another showing degenerate ganglion cells resulting from sunstroke. One of the most popular exhibits was that by R. L. Ditmars, consisting of four living snakes and a preparation under the microscope illustrating the change produced in normal blood by the infusion of snake venom. The snakes exhibited were a water moccasin five feet long, a very black rattlesnake, a coral snake and a corn snake. The last is a light, copper colored creature very handsomely marked.

During the evening, Dr. A. A. Julien gave a brief lecture, illustrated by the stereopticon, on the subject "The Travels and Experience of a Sand Grain," in which he gave, in an interesting, popular manner, illustrated by lantern slides, the history of a fragment of rock torn off from some mountain peak by frost or some other agency, until, broken up and disintegrated by abrasion and the solvent action of water, the enduring portion has been deposited in sand banks along rivers, lakes and ocean, while the altered portion has formed beds of clay or mud, or been carried in solution out into the ocean. In arid regions wind plays an important part in the formation and transportation of sand.

In addition to water worn and wind blown sands, those derived from explosive eruptions of volcanoes are of importance, and those made up of the skeletons of organisms (diatoms and radiolarians) are worthy of note. Dr. Julien also presented, but did not elaborate, his scheme for classifying sands according to the size of grain, nature of components and origin.

The officers of the Microscopical Society for 1897 are: president, Frank D. Steel; vice president, F. W. Leggett; secretaries, J. E. Ashby and J. L. Zabriskie; treasurer, James Walker. The committee on the annual exhibition, to whom, together with the museum authorities, is due the success of the event, was J. W. Kosmak, Thomas S. Nedham and Stephen Helm.

M. SALOMON REINACH has just published a pocket edition of Clarac's "Répertoire de le Statuaire grecque et romaine." There are 890 plates which are of greatest possible use to the student. A complete and well arranged index has been provided, as well as a bibliography. Clarac's text is of course disregarded. In spite of the small sized reductions, the details are clearly defined. Both the editor and the publisher, Leroux, of Paris, are to be congratulated for having thus placed a most useful work within the reach of all students of ancient art. The book is sold at the moderate price of five francs.

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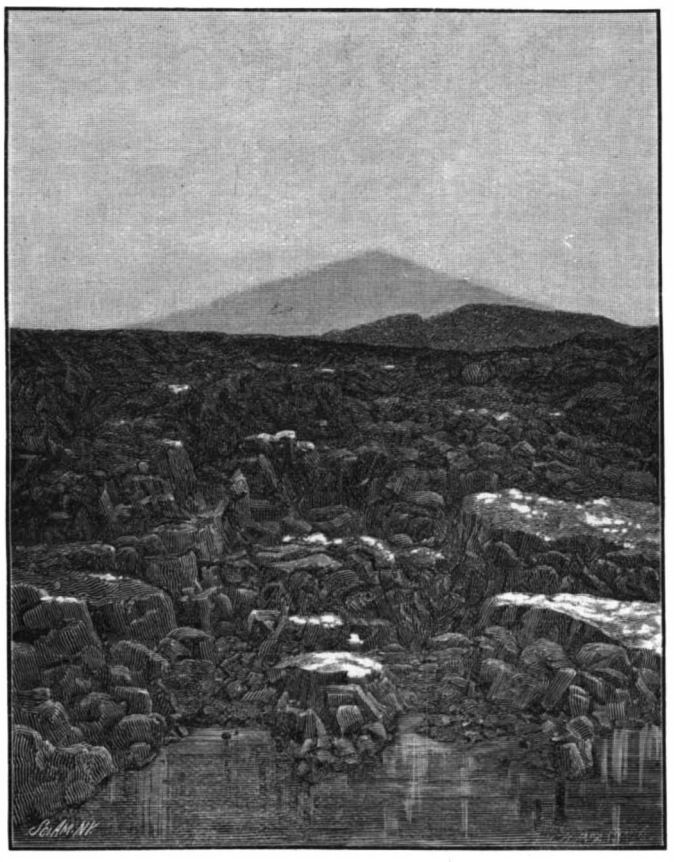
MOUNTAIN SHADOWS.

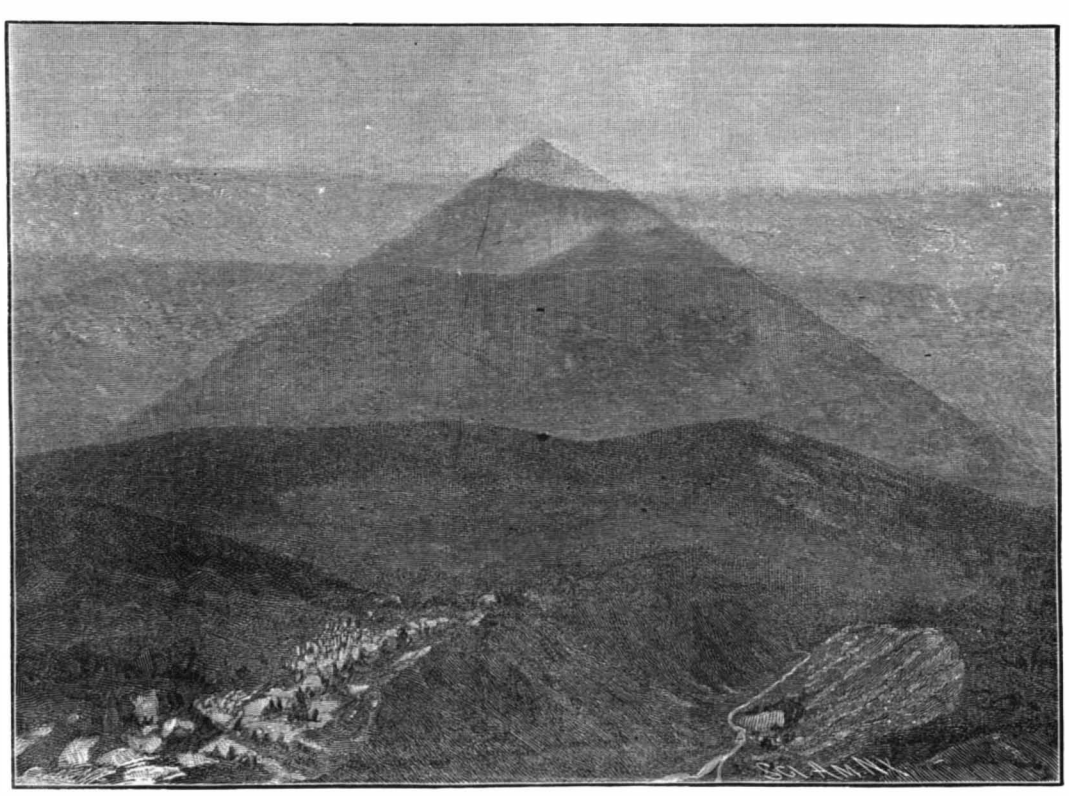
The curious natural phenomenon which the accompanying pictures illustrate is one which is rarely seen, although it is of common occurrence, since it is produced only by very high peaks.

A high, prominent mountain peak, which towers above all its neighbors, will, when the sun is near the horizon, cast a distinct shadow upon the clouds behind it; and at times this shadow is very marked indeed. The larger photograph which we reproduce shows the shadow of Mount Hood cast in this way by the rays of the setting sun. The outline of the mountain extends across the center of the picture, while in the distance other ridges are dimly visible through the smoke clouds, upon which the shadow of the peak is projected. The height of Mount Hood is 11,225 feet. That the clouds are by no means necessary, however, in order to obtain a shadow, is demonstrated by the other photograph, which shows the shadow of Pike's Peak cast upon a perfectly clear sky. This famous peak is 14,147 feet high. The air in the high, upper region about the peak is so very clear that it seems well nigh impossible a shadow should be cast upon it: but, however clear it may appear to the eye, it contains enough dust particles or motes to receive the shadow of the peak, and thus a startlingly distinct silhouette of the mountain is produced.

If one happens to be near the top of a high peak toward sundown, and on the side away from the sun, a good idea of this interesting phenomenon may be readily obtained; but as most people seldom have the fortune to be so placed, we feel sure our readers will be interested in seeing how it appears in the eye of the ever-present camera.



SHADOW OF PIKE'S PEAK AGAINST A CLEAR SKY.



SHADOW CAST BY MOUNT HOOD OREGON.

Facts About Blotting Paper.

In England they use a thin blotting paper; here we use mainly a thick blotter, says the New York Sun. Such thin blotting paper as is used here is chiefly for blotting leaves in books. Here we use on a desk a sheet of blotting paper 19×24 inches, the standard size, which may be turned over when one side is pretty well filled with ink. In England the thin blotting paper is folded a number of sheets together, making a sort of pad, something larger than legal cap paper, and when a leaf gets saturated with ink it is torn off.

Blotting paper is not new, but it was first made in this country only about forty years ago. Before that time we used some of the thin English blotting paper, imported; but, more commonly, to prevent ink from blotting, we used sand, which was poured upon the written sheet out of a sand box. The sand box was a common article of desk furniture, as the wafer box was at one time, and almost as commonly seen as the inkstand. It was made sometimes of tin, sometimes of wood. It was, perhaps, three inches in height, and may be two and a half inches across the top, where its diameter was greatest. It was something like a pepper box in the manner of its use; but as to shape, instead of having a convex top, it had a concave top, like a little saucer. The bottom of this saucer was perforated. The box was filled with sand through these perforations. When the box was used sand was poured from it upon the writing. A little of the sand adhered to the fresh ink and kept it from blotting. Very much the greater part of the sand poured out lay scattered upon the paper. Lifting the book or paper, the surplus sand was poured back into the box.

Many of the wooden sand boxes were handsomely turned aticles. The sand used was a peculiar fine, black sand of uniform grain, brought from Lake George, in this State.

At the time of the civil war in this country blotting paper had come into comparatively common use. It is only within fifteen or twenty years, however, that it has come into the wide and very nearly general use of the present time. Now the sales of it increase with the population or more rapidly. There are American paper mills devoted wholly to the manufacture of blotting paper, and their products amount to thousands of tons annually, and American blotting paper is now an article of export. We still import a little English blotting paper, but only a very little; not enough to cut any figure in the market.

The very best blotting paper is made wholly of cotton rags. Some poorer grades are made partly of wood pulp and with it may be some clay. Such papers, as they dry out, become still less absorbent. The addition of dyes to blotting paper makes it less absorbent. English blotting paper is made usually of from twenty to forty pounds to the ream. American blotting paper is made from forty to a hundred and fifty pounds to the ream. Blotting paper colors are white, blue, granite (a very light gray), yellow, and pink. It is made in various shades of these colors. There is sold of white blotting paper ten times as much as of any other color.

Some of the calenders used in calendering cloths are made of blotting paper, sheets of which are pressed together to form a roll.

There still comes now and then, to the wholesale stationery dealer in New York, a call for Lake George sand, showing that there are yet some users of the old time sand box; but these calls are now so rare that they are no longer supplied, and the sand boxes have long since ceased to be a part of the wholesale stationer's stock. There, however, may still be found at some retail dealer's a few left over from years ago; and occasionally one of these is sold. A city stationer sold one only the other day, but it was not to be actually used as a sand box; it was to finish out the equipment of an old-fashioned desk.

Preservation of Bread by the Use of Waxed Paper.

So much has been written within the past few years regarding the communication of diseases through bacilli microbes found in dust, etc., that practical methods are being introduced to counteract their extension or growth. One of the latest ideas is the protection of such an important article of food as bread. In our cities a large proportion of the bread consumed is supplied by bakeries. Bread from such places must, of necessity, be handled several times by different employes, and it sometimes happens that bacilli germs become attached to the bread during the handling, either from contamination from the hands or perhaps from the clothes of the person making the delivery. So, to protect the bread from such possible contingencies, the custom is being introduced in many places among bakeries of wrapping each loaf, as soon as it is baked, in a sheet of waxed paper, sealing the knot of the string holding the paper surrounding the loaf. The bread is not only in this way well guarded from bacilli germs, but is also kept moist and fresh, as the waxed paper prevents evaporation of moisture, while the consumer is certain to receive an article that can be depended upon as healthful and good, without regard to the number of handlings it has undergone.

The idea of wrapping bread, cake, confectionery, tobacco, soap, meat, etc., in waxed paper to preserve their freshness is quite old, but the use of the paper as a guard against the communication of disease germs is comparatively new, yet it is so practical that it is surprising it has never been thought of or advocated before.

Nature Study in the Chicago Schools.

A plan for systematic outdoor or field work in connection with nature study, to be carried on by the pupils of the public schools of Chicago, has been reported by a committee of sixty teachers which was appointed in May, 1896, by the Chicago Institute of Education. The features of the plan may perhaps be best understood by indicating the duties of the subcommittees which the general committee has instituted to care for its various special features, says the Popular Science Monthly. First is the executive committee, the purpose of which is to devise ways and means for carrying the whole into effect and to second the efforts and work of the other subcommittees. A committee on maps will prepare maps of the environs of Chicago to assist the pupils and teachers in a systematic study of the country at a convenient distance around the city: these maps to comprise large maps, each including only one of the most conspicuous geographo-geologic features, and smaller maps showing details—the location of the specific features of interest. The maps already made by Prof. T. C. Chamberlin, and kindly offered by him, will be used as the basis of this work.

A committee on syllabi is to prepare printed outlines and suggestions which will intelligently and economically direct pupils and teachers in their consideration of the different areas and subjects chosen for study. The syllabus should not be compiled information, but should simply suggest the problems that are furnished for study by each area and indicate lines and methods of investigation. A fourth committee will look in the libraries after the books that may be useful to the pupils engaged in nature study and available for their use. A committee on instruction and school exhibits will make themselves acquainted with the work of nature study in the schools and with the teachers engaged in it, and make monthly reports to the committee of sixty of what is actually being accomplished, and will establish at some suitable place a permanent exhibit illustrating the character of the work. A committee of public information will see that all these things are made known and kept in mind. A committee on transportation will try to interest the railroads, etc., in the scheme, and to secure convenient facilities and privileges for the transportation of pupils and parties going out to fields of nature study. Arrangements will be made for frequent trips of small numbers, rather than for larger excursions at longer intervals, which might give the affair too much the air of a picnic. Hence it is suggested that only the pupils of one or two rooms be sent out at a time, under the immediate supervision of their teachers. A committee on finance and a conference committee are also instituted for the purpose indicated by their titles. It is anticipated by the committee of sixty that, when once under way, this plan will be expanded to include every department of school work.

A STICK of timber 119 feet long and 22 inches square, without a knot or blemish, was cut in a mill at Hoquiam, Wash., recently.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SWITCH LEVER.—Gustave J. M. Van Neste, Brussels, Belgium. The invention covered by this patent is an improvement on a former invention of the same inventor, and provides for pivoting a weighted arm on the switch lever itself as its axis, the parts being so adjusted that the arc through which the switch lever moves to operate the switch shall be wholly on one side of a vertical plane if the return motion is to be automatic, or about equally divided by the vertical plane if the action is to be non-automatic, or indifferent in either direction, the change of relation with regard to the vertical plane being effected by varying the length of the switch-operating rod. The apparatus is thus readily rendered automatic or non-automatic as regards the return of the switch to a normal position.

RAILROAD TIE.—Benjamin Bradley, Sr., Bellefonte, Pa. This tie is formed of plates of angle iron or steel having near their ends offsets forming chambers in which are held bearing blocks. The ties are twelve to thirty inches wide, the wide ties for use where the road is straight, and each tie constitutes a metallic frame, between the ends of the side plates of which are wedged the bearing blocks. The rail locks fit the outer and inner sides of the rails, and are bolted to the side plates, spikes being dispensed with. The frame, when in position and properly ballasted, is designed to be practically indestructible.

RAILWAY CROSSING GATE.—Morris Sober, Oklahoma, Oklahoma Ter. According to this invention a spring-controlled shaft has attached trip rails arranged to engage the flanges of the wheels of a passing train, and these trip rails actuate guard bars to force the gate down to a horizontal position while the train is passing, the springs restoring the gate to its upper position after the train has passed. The arrangement is such that the pilot of the engine will operate to press the gate downward should the trip rails fail to operate.

Mechanical.

REVERSING MECHANISM.—Frank E. Gowen, Norrie, Pa. To impart a turning motion in either direction to a shaft, wheel, etc., this inventor has devised a mechanism comprising an arm mounted to swing loosely on the shaft of a ratchet wheel, while a lever fulcrumed on the arm carries a double pawl adapted to engage the ratchet to turn it in either direction, the lever and arm being adapted to be locked together. The patent shows the improvement applied on a sawmill carriage and head block, where the operator, by simply taking hold of the handle of a lever, can give the desired motion to the setting shaft, either forward or backward.

COMBINATION TOOL.—Robert Campbell, Elizabeth, N. J. This is a tool which may be used as a square, marking gage, miter, trammel, caliper, etc., the invention consisting principally of a stock with bearings standing at right angles to one another and in different planes and a blade adapted to engage and held adjustably in either bearing.

NUT LOCK.—Frank L. Shunk, Grantsdale, Montana. According to this invention the bolt has an angular extension beyond its threaded portion, and the nut has a recessed lug projecting from its outer face, a washer with an angular opening fitting on the angular extension of the bolt. Ratchet teeth project radially from the washer to enter the recess of the lug and lock the washer in contact with the nut and the nut on the bolt. The device may be quickly adjusted and operates efficiently to prevent the accidental displacement of nuts from bolts.

GANG SAW FOR MARBLE SLABS.—John J. Dimond, New York City. In this machine a reciprocating frame has in its end pieces adjustable bars with hooks attached to saw blades, permitting the latter to swing or turn laterally, there being on each side of the saw frame pattern guides and keepers to control its vertical movement, while a guide for the saw blades has transverse slots corresponding to the shape of the pattern guides, whereby the blades accommodate themselves to the shape of the cut to be made. The machine is designed to facilitate the sawing of slabs of marble of various forms by gang saws, employing the ordinary gang saws now in use.

SAW SHARPENING MACHINE.—Frank Parsons, Montgomery, Miss. This machine comprises a table on which is a chuck and a drive shaft carrying an eccentric driving a second and smaller eccentric, while a slide connected with the driven eccentric controls the movement of the table. After the saw has once been placed in proper position the operation of sharpening and feeding is automatically accomplished, and provision is made for the keeping of a record by which the same saw may be quickly and conveniently placed in position upon the machine at any time.

BEDSTEAD MAKING MECHANISM.—Augustus D. Newberry and William J. Melvin, Fayetteville, N. C. These inventors have devised a machine by which the locking plates and pins of a bedstead may be quickly secured to the bed rails and posts, and the work be better done by the machine than it is possible ordinarily to do it by hand. The machine comprises a combination of suitable holding devices, chutes for delivering the securing pins, punches and means for reciprocating them, guides, and a locking device for holding the punches intermediate of their stroke. The operator can be certain, with this machine, to have the locking pins accurately placed, without danger of injuring the wood portions of the bedstead.

Agricultural.

MILKING MACHINE.—Carl B. Stroyberg, Roskilde, Denmark. The pressure exerted by air cushions, according to this invention, is designed to facilitate the milking action. The teat receivers comprise inflatable sections, a casing receiving a supply of compressed air, and connections permitting the adjustment of the receivers relatively to the casing that supplies the air. The compressed air is supplied by means of an air pump, and the initial pressure is exerted on the teats at their bases and then along their length, the milk being received in any suitable pail or vessel placed beneath.

WATER TROUGH FOR STOCK.—James F. Elliott, Manson, Iowa. An improved self-regulating trough for watering hogs and other stock is provided by this invention, the trough being adapted to supply a number of distantly located drinking cups. A tank is connected with a water supply by a pipe having a self-regulating valve, and one or more pipes lead from the tank, each of the latter pipes being connected with a post on which one or more drinking cups are held, the tank thus supplying the several drinking cups constantly with water. The water removed by the stock is instantly supplied again from the tank, and the latter is kept replenished by the action of the self-regulating valve in the primary supply pipe.

Miscellaneous.

SPROCKET WHEEL AND CHAIN.—John C. Cottie, New York City, and Charles J. Marks, Brooklyn, N. Y. An improvement especially adapted for bicycle use has been devised by these inventors, the wheel having rolling surfaces, or ball bearings, for engagement with the chain, the balls being held in cleats on the periphery of the wheel, and forming substitutes for the usual teeth of a sprocket wheel. The roller surfaces are between web flanges, making the wheel self-cleaning and the chain not liable to catch in a garment. In the chain each alternate link is double, the connecting link being single, and the teeth are placed at one side of the transverse center of the links, forming segmental pockets of different sizes, giving a maximum clearance without detracting from the pulling or pushing power of the chain.

PNEUMATIC TIRE.—William L. Stewart, Wilmerding, Pa. According to this improvement the outer tube or cover of the tire is made of a flat band of rubber coated fabric in whose opposite edges are eyes or hollow beads through which extend wires connected by hook latches when the cover is placed in position, an overlapping flap then covering the inner surface of the joint, and its outer edges lying in a groove in the rim. There are turnbuckles at each side of the valve tube by which looseness in the binding wire may be taken up while the tire is deflated. A tire of this construction may be easily removed from or placed in position on a wheel, as it does not depend upon the compressibility of the rubber of the outer tube or cover to hold the tire in place. The wire and fastener may be used with any form of hose pipe or double tubed tires, doing away with the use of cement and strengthening the wheel rim.

BOTTLE AND STOPPER.—Wilbur F. Hyer, Meridian, Miss. A bottle which cannot be a second time presented as an original package has been devised by this inventor. Its neck has an exteriorly threaded collar, below which is a flange, and the corked bottle is covered by a thimble which has at its lower edge a flange resting on the collar. A nut screwing on the collar engages the flange of the thimble, and is held in such position by a locking pin which cannot be readily removed without breaking some of the parts.

CEMENT MATERIAL FROM BLAST FURNACE SLAG.—Alexander D. Elbers, Hoboken, N. J. To adapt slag for use with hydraulic cement as an ingredient for mortar, this inventor has devised a process for treating the ground slag with a weak solution of nitric acid, thus superficially desulphurizing it and impregnating it with nitrosyl. It is supposed that the still sulphurous interior of the slag particles will not be affected by the chemical reactions likely to take place in applied cement, either submerged or exposed to the air, while the absorption of nitrosyl prevents the ferruginous slag from changing superficially to ferric hydrate.

NAIL OR TACK DRIVER.—Thomas J. Langston, Johnston, S. C. This is an implement readily carried in the hand, in which nails or tacks may be put and automatically arranged and fed to the driving mechanism, one at a time. A plunger is arranged in a hollow handle having an exterior chute or slideway for the nails or tacks, there being on the handle a driving head having guide wings forming a slideway and continuation of the chute, while a pivoted, spring-pressed and grooved tongue is arranged parallel to and forms part of the nail pathway. The driving end is held lowest in filling the implement with nails or tacks, which are sprinkled into the hopper.

PUMP.—James P. Wintz, Sour Lake, Texas. To readily pump oil or quicksand from wells, the suction pipe which extends into the well casing, according to this invention, is provided at its lower end with a funnel, the base of which engages the wall of the casing to divide its upper from its lower end. A valve forms a flexible connection between the base of the funnel and the inner surface of the casing, for the upper compartment of which there is a water supply pipe and an indicator marking the height of water in the compartment, and the flexible connection permits a downflow of water to cause the oil to rise to the lifting range of the upper plunger.

FIFTH WHEEL.—William H. Bradshaw, Orange, N. J. This device consists of a circular track at each edge of which is a recess to receive the vertical members of an inverted U shaped cover, between which and the track is held a series of rollers extending entirely around the track, the spindles of the rollers being journaled in a band on each side forming side sections, permitting the rollers to revolve freely at spaced distances apart, no matter what weight may be brought on the upper or cover member.

MANIFOLDING ATTACHMENT FOR BOOKS, PADS, ETC.—Edward D. McKenna, Brooklyn, N. Y. Two patents have been granted this inventor, one of which is more especially for an attachment for books used by salesmen and others, to give a bill and retain a duplicate, the attachment being simple and compact, and providing for the moving of the copy sheet to receive a new entry at each time that the book is opened. According to the other invention the carbon paper may be attached to a removable cover or to a roll, and the roll and a support therefor detachably attached to the book in which manifold copies are to be made, any desired length of carbon or transfer paper being drawn from the roll and carried between leaves. The roller may be plain or spring-controlled, and the carbon paper after use may be returned to the roll and be entirely out of the way, thus obviating the inconvenience of a loose sheet, liable to frequent displacement.

SKATE ATTACHMENT.—Luke W. Kenney, New York City. To facilitate the attachment of an ankle support at the heel portion of a skate, this inventor has devised for the support an attaching plate which may be applied to a club skate without interfering with the action of any of its parts, the invention also constituting an improvement upon heel plate attachments forming the subject of two other patents previously issued to the same inventor. The ankle support comprises a yoke to the upper portion of which are pivoted bowed arms from which straps extend around the leg above the ankle, and the attachment may be made to roller skates as well as to ice skates.

SAFETY BELT.—Ella I. Cooley, Coldwater, Mich. To secure a child in a high chair or in a carriage, according to this invention, a waist belt around the child is connected to a retaining strap around the back of the chair, or other fastening, by an elastic loop band, and, to restrict the movement of the elastic band, a second strap, with buckle, is also used to connect the retaining strap with the waist belt.

BOSOM PAD.—Dora Harrison, Lansing, Mich. To fill the breast pockets in corsets and other garments, and insure a proper fitting of the dress, an inflatable pad, according to this invention, is inserted in a cylindrical shell made of silk or similar fabric, with draw strings at its ends. The inflatable pad is made of very thin rubber, rendered non-odorous by special treatment, and the two breast shaped compartments are connected by a contracted tubular part from which extends a small filling tube, by which the wearer may inflate the compartments as desired.

DRESS SHIELD.—This is a further invention of the same inventor, according to which the shield is composed of an inflatable central or saddle portion and inflatable side portions arranged side by side, the portions communicating with each other and there being means for attaching the shield to a garment. The compartments are inflated by a filling tube, and the shield yields readily in every direction, affording perfect freedom to the arms without danger of binding.

FOLDING BED.—Oscar D. Reichard, Philadelphia, Pa. A bed for use as a crib, or in connection with a couch, is provided by this invention, one folding up conveniently to be stored under an ordinary bedstead. The invention consists principally of a holder or platform adapted to receive the mattress and bedclothes, the holder being hung at its ends on links connected with hinged parts of the bead and foot boards of the frame. The bedding is held horizontally whether raised or lowered, there being no springs or weights required, and the bed not being liable to get out of order or fold or close up.

IRONING TABLE.—Howard Rupert, Philadelphia, Pa. The ironing board of this table has a tapering end resting on a trestle, the other end resting on a hinged leg, whose inclination may be varied to raise or lower the board. A wire frame, covered by canvas, is removably held inside the table legs to form a clothes support, and on the top of the ironing board is held a curved sleeve board, which may be reversed to bring either edge on top to facilitate the proper ironing of sleeves or other garments. The table may be conveniently folded for storage in small space.

HYDRAULIC AIR COMPRESSOR.—Frederick A. Erbe, North Beach, N. Y. To compress air to force beer to faucets, as a substitute for the ordinary beer pump, and for other purposes, this inventor has devised a hydraulic compressor comprising a peculiar combination of floats and weights within a tank with which water connection has been made. The floats and weights automatically open and close the water inlet and exit valves and the air inlet valve, so that the tank is alternately filled and emptied of water and air, the air being compressed in the tank before it is discharged.

EXTRACTING LOOP SEALS FROM BOTTLES.—Charles F. Schield, Cambridge, Ohio. The extractor for seals and stoppers which forms the subject of this patent has a cam mounted on a spindle, a lever fulcrumed on and having an offset for engagement with the cam, while a foot at the opposite end engages the seal or stopper. A tension device connected with the offset end of the lever acts to normally hold its foot out of position for engaging the stopper. The device facilitates the quick removal of seals, no matter how tightly they may be seated in the necks of the bottles.

HERNIAL TRUSS.—William B. Starbuck, Nantucket, Mass. This truss has a pear shaped pad cased in leather, there being a staple in the back of the casing with which the body belt is connected, while the leg strap is secured to the small end of the pad and adapted to buckle onto the body strap.

STOVE POLISH.—Edwin G. Rust, Primghar, Iowa. A brilliant black polish, according to this invention, is made of ivory black, black lead, quince seed mucilage, gelatin, alcohol and water, combined as described in specified proportions. The polishing liquid quickly dries when spread on the metal surface, and the surface may then be polished with but little labor by a dry brush or a soft cloth.

Designs.

DISH DRAINER.—William O. Campbell, New York City. This is a convenient receptacle in which to place dishes after washing and to facilitate rinsing them. It has a body tapering inward toward the bottom and a tapering spout, in front of which is a rod resting in sockets in the sides of the body.

INCANDESCENT LAMP BULB.—Lawrence H. Dolan, Alexandria, Ind. This bulb has an annular hood whose top surface tapers outward from the shank, and below the hood it has something of a cup formation, ornamented by intersecting lines forming facets, the central bottom part of the cup portion terminating in a point.

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(7149) B. & M. write: We have a bicycle gear to 70; 20 tooth front sprocket and 8 rear. If we change the sprockets to 40 and 16 respectively, we still keep the same gear 70. Have we reduced the breaking strain on the chain? If so, about how much? A. You have reduced the strain to one-half.

(7150) C. W. K. says: Can you put me in the way of obtaining a transparent waterproof cement that will unite two flat surfaces of mica? A. A colorless cement for joining sheets of mica is prepared as follows: Clear gelatine is softened by soaking it in a little cold water, and the excess of water is pressed out by gently squeezing it in a cloth. It is then heated over a water bath until it begins to melt, and just enough hot proof spirit (not in excess) stirred in to make it fluid. To each pint of this solution is gradually added, while stirring, ¼ ounce of gum ammoniac and 1½ ounce of gum mastic previously dissolved in 4 ounces of rectified spirit. It must be warmed to liquefy it for use and kept in stoppered bottles when not required. This cement, when properly prepared, resists cold water.

(7151) C. E. B. asks: 1. What is the buoyancy of a vacuum per cubic foot? A. About 537 grains per cubic foot. It varies with the temperature and barometric pressure. 2. Is it possible to remove tattoos? A. Our SUPPLEMENT, Nos. 695 and 1078, has articles on this subject.

(7152) E. S. B. asks: How many cubic inches of water can be changed into its two gases by a dynamo run by a two hundred horse power engine per second? A. A fair allowance for voltage required to decompose water is 2 volts. This provides an ample excess. The engine may be taken as developing by the dynamo 100,000 to 130,000 watts at 2 volts, or 50,000 to 65,000 amperes. This would give from 0·28 to 0·36 cubic inch of water per second. Of course the current could be greatly reduced by passing it through successive decomposition vessels in series, and using a higher voltage, but this would be at the expense of a great deal of energy.

(7153) L. A. McK. asks: In simple electric motor described by George M. Hopkins in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, should the Russia iron strips in the field magnet be cut lengthwise with the sheet, that is, with the grain, and would it decrease the motor's efficiency any to cut them crosswise with the grain? A. It is quite immaterial how the sheets are cut.

(7154) I. E. P. asks: Is the specific gravity of an object altered when enveloped in compressed air. If so, to what extent? A. As the specific gravity of bodies is measured under atmospheric pressure, any increase of density in the air will slightly decrease the specific gravity. As air at mean temperature is nearly 800 times lighter than water, at 15 pounds excess of air pressure its density would be doubled, and a body should have less specific gravity by $\frac{1}{855}$ of its value in the compressed air.

(7155) H. J. asks: 1. What is the resistance of a standard 16 candle power 110 volt lamp? A. 244 ohms. 2. Of a 16 candle power 52 volt lamp? A. 37 ohms by the Edison rating. 3. Is the resistance the same when cold as when burning? A. No; the above are hot resistances; the resistances cold are less.

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PENNSYLVANIA: COLONY AND COMMONWEALTH. By Sydney George Fisher. Philadelphia: Henry T. Coates & Company. Pp. 442.

In a previous volume, "The Making of Pennsylvania," the author presented an account, full of interest, of the nationalities and religions that made up the population of the province. The present work gives a condensed general history of the State as a whole, showing the growth of civil and constitutional liberty, the transition from the colony to the commonwealth, etc., and is particularly illustrative of nearly a hundred years in which the administration of the province was entirely in the hands of the Quakers. The history proper closes with an account of the whisky rebellion of 1794. It is full of delightful reminiscences and interesting details not found in the usual historical accounts.

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(Continued on page 270)

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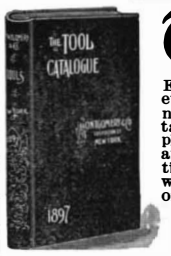

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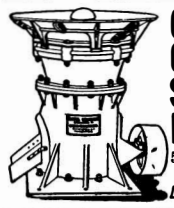

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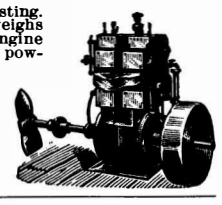

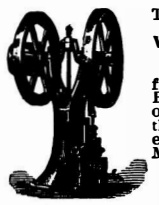

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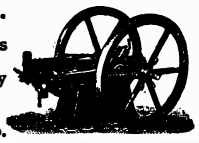

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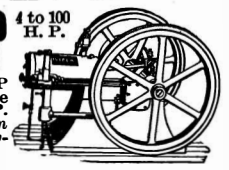

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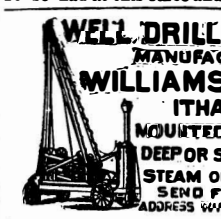

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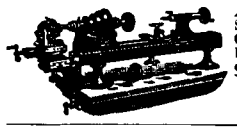

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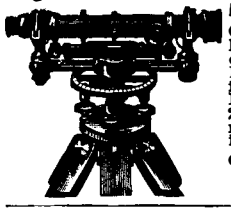

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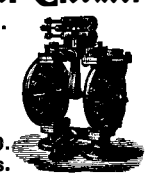

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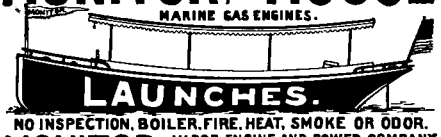

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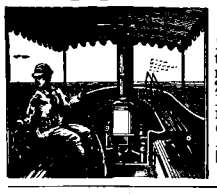

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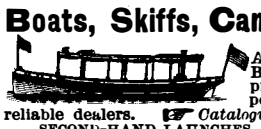

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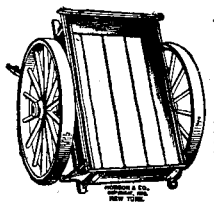

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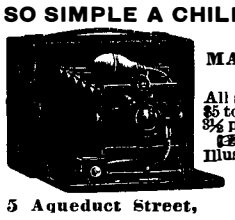

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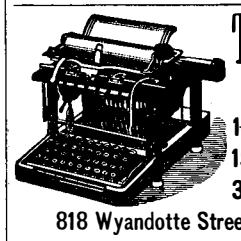

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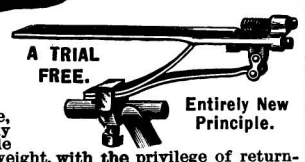

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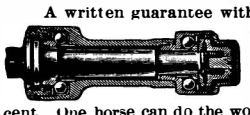

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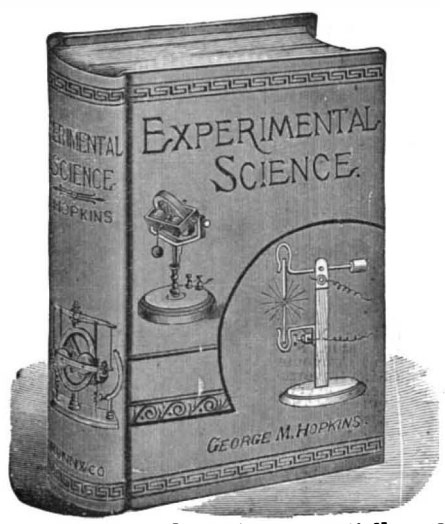

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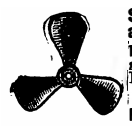

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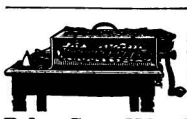

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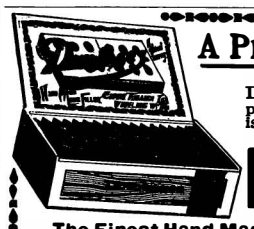

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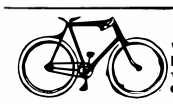

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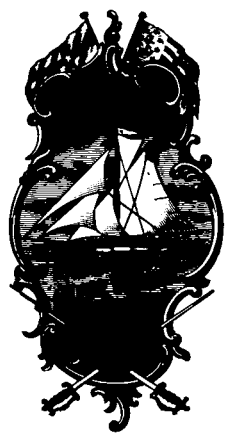

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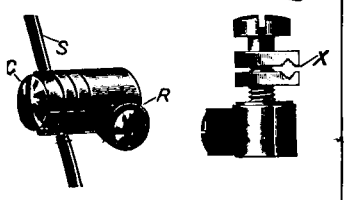

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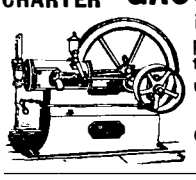

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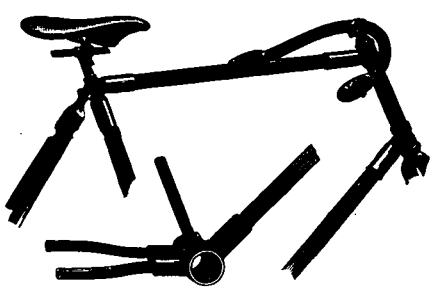

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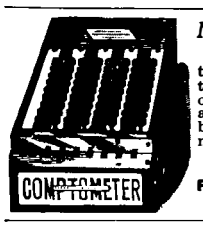

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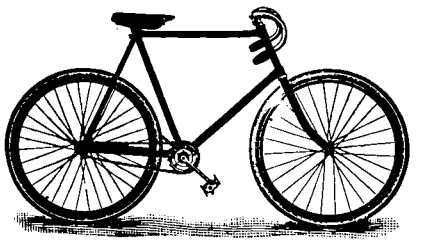

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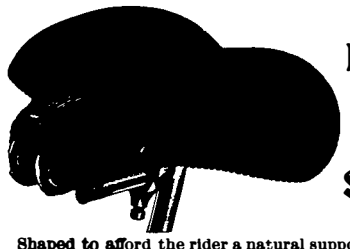

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